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Preliminary Forest Habitat-Types of Northwestern Utah and Adjacent Idaho

by

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CONTENTS

INTRODUCTION

Following pioneering work in northern Idaho and eastern Washington by Daubenmire 1952, 1968, and later in Montana, Idaho, Wyoming and Utah by Pfister et al., 1974, Steele et al., 1974, 1975, Cooper 1975, Reed 1969, Ream 1964, and Pfister 1972, work was begun to finish identifying and naming the forest habitat types of Utah. Preliminary work had been done by Pfister (1972) on the subalpine fir and engelmann spruce series. This current work covers all forest land in Utah and adjacent southern Idaho including that covered by Pfister.

Field work in northewestern Utah and adjacent Idaho began in June 1975. This report represents the preliminary classification based on that work.

STUDY AREA

The study area (Figure 1) includes the Wasatch Mountains from the southern boundary of the Western Wasatch National Forest to the northern most point of the Bear River Range near Soda Springs, Idaho (Wasatch and Caribou N. F.s). The Wellsville Range, a spur of the Wasatch Mountains was also visited. In addition, the Albion, Sublette, Black Pine and Malad ranges of Idaho were briefly sampled (Sawtooth and Caribou N.F.s). The Raft River, Ouquirh and Stansbury ranges of Utah were included also (Wasatch and Sawtooth N.F.s.).

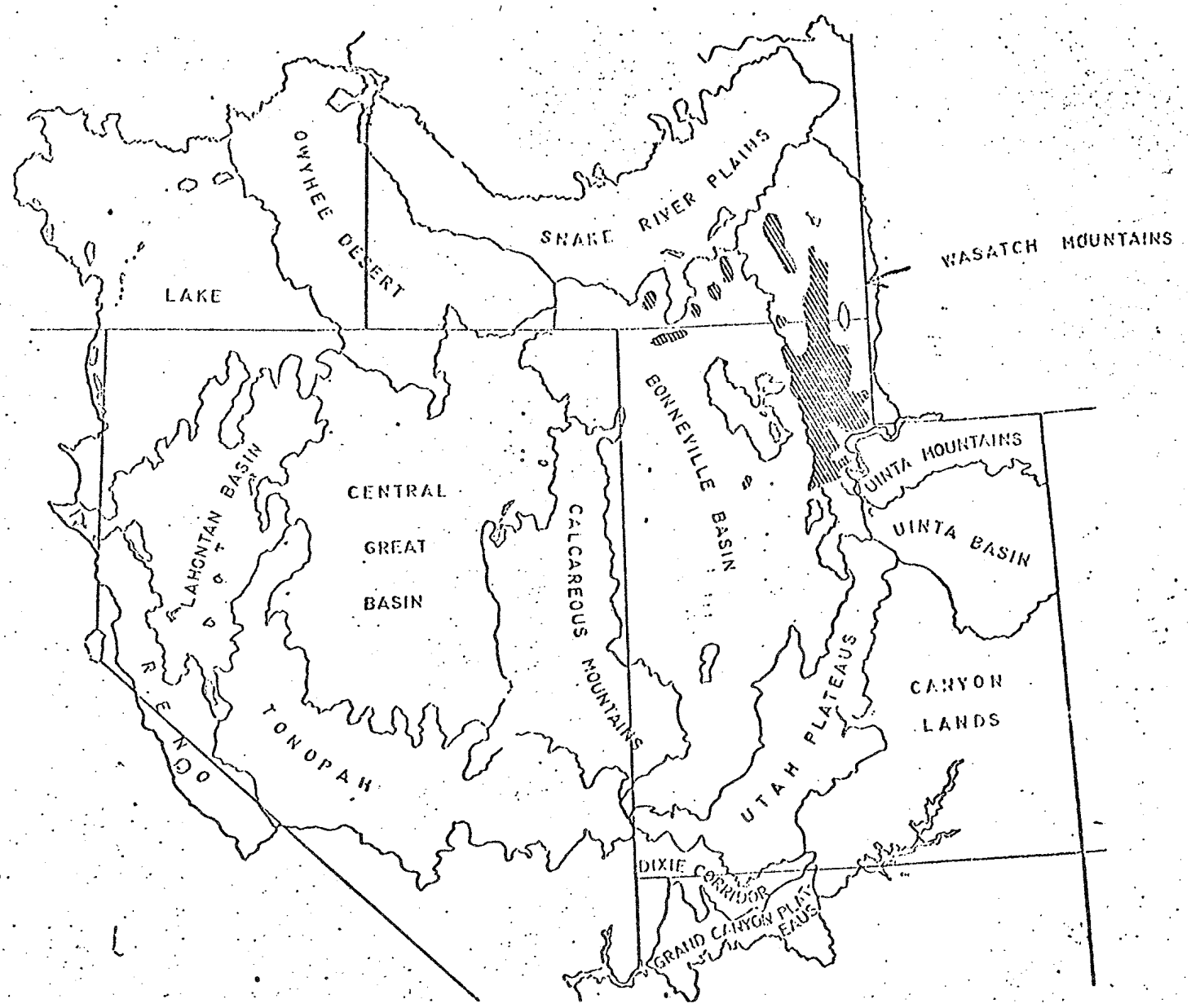

Figure 1. Map of the Intermountain Region showing distribution ( ) of forestland in northwest Utah and adjacent Idaho.

RESULTS

Since this is a preliminary classification detailed accounts of the habitat types are not presented here. This will be forthcoming when the final classification is released.

Keys are presented to the forest series and habitat types in our area. Occurrence of tree species and successional roles and average site index are given in Table I. This provides basic information for selection of tree species based on their environmental adaptation to specific habitats.

Constancy and average cover data are given in Table II by habitat type. They are useful for understanding the species compositions associated with each habitat type. Comparison of the types based on this compositional information provides an understanding of the classification that cannot be gained simply by using the key. This table also reduces the need for elaborate descriptions of each type.

The habitat type and community descriptions (pages 7-79) are arranged by "series", based upon the climax tree species; series is the primary subdivision in the classification system. Descriptions of types are intentionally brief and will be expanded upon completion of the study one year from now.

The management implications are also brief at this time. Some of our observations cannot be completely evaluated without additional research. Further management implications should be developed by other studies related to this classification framework.

The types presented in this report are preliminary. Your assistance can greatly aid completion of this project and improve the accuracy of the final system. Any stands not fitting this classification framework need to be considered in the final classification. For any stands that fit poorly into this classification, please complete a stand description including understory species by cover plus stand location and send this information to us. We will try to pinpoint the problem in classifying the particular stand, and will, if necessary, visit the problem area to include it in our final analyses. The users of this system are, in effect, testing its applicability and any feedback, positive or negative, will be appreciated. In addition to supplementary sampling of problem areas in our preliminary classifications, we will visit areas adjacent to the study area. The data from areas surrounding the core study area will help insure that the final classification will present each habitat type in its proper ecological perspective.

KEY TO SERIES AND COMMUNITY TYPES

1. *Abies lasiocarpa* present and reproducing successfully[1] . . . . . ABIES LASIOCARPA Series (page 7)

1. *A. lasiocarpa* not the indicated climax tree species

    2. *Abies concolor* present and reproducing successfully, clearly not an accidental (usually in the *Pseudotsuga menziesii* series) . . . . . .

        3. *Quercus gambelii* at least 25% overstory canopy coverage . . . . . ABIES CONCOLOR-QUERCUS GAMBELII Series (page 38)

        3. *Q. gambelii* less than 25% overstory canopy coverage . . . . . ABIES CONCOLOR Series (page 38)

    2. *A. concolor* absent or accidental

        4. *Pinus flexilis*, a successfully reproducing dominant, often sharing that status with *Pseudotsuga* . . . . . PINUS FLEXILIS Series (page 48)

        4. *P. flexilis* absent or clearly seral

            5. *Pseudotsuga menziesii* present and usually reproducing successfully . . . . . PSEUDOTSUGA MENZIESII Series (page 56)

            5. *P. menziesii* absent or accidental

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[1] *Abla* should be able to develop at least 5% cover or 10 trees per acre to be considered successfully reproducing.

6. Populus tremuloides the only dominant tree species . . . . . POPULUS TREMULOIDES Communities (Page 75)

6. P. tremuloides not dominant

7. Acer grandidentatum or Q. gambelii dominant . . . . . ACER GRANDIDENTATUM and QUERCUS GAMBELII Communities (page 77)

7. A. grandidentatum and Q. gambelii not dominant . . . . . Other unclassified communities.

ABIES LASIOCARPA SERIES

The Abies lasiocarpa series occurs at higher elevations throughout our area, extending from the upper limits of the Pseudotsuga menziesii series to upper timberline. Abies lasiocarpa mixes with Picea engelmannii in the upper part of its elevational range to form the "subalpine" or "spruce-fir zone."

Stand structure in this area is intimately associated with Abies lasiocarpa's susceptability to insects and disease. Root and butt rots, and to a lesser extent trunk rots, are largely responsible for this tree's relatively short life span. Yellow witches' broom, Melampsorella caryophyllacearum, can cause significant growth impact with moderate levels of infection. Bark beetles and trunk borers serving both in a primary and secondary capacity, are also responsible for a great deal of mortality. Once weakened, trees are more susceptible to windthrow or stem breakage, creating openings in the canopy.

Picea engelmannii, however, is more resistant to such pathogens and insects in our area. Given such a considerable longevity advantage, it often maintains a major position in climax stands. In many stands, Picea can be considered as a co-climax while on others it plays a seral or late seral role.

Pseudotsuga menziesii, Populus tremuloides, Pinus contorta are important seral species in the series. Pseudotsuga often becomes the major seral species at the lower elevations of this series. It frequently dominates Abies and can be the most productive timber species on these sites.

Douglas fir dwarf-mistletoe, Arceuthobium douglasii, is sometimes present.

Pinus contorta can also be an important timber species in parts of this series and is often found dominating sites that were previously disturbed. Throughout this area, various stem rusts, porcupine activities and dwarf-mistletoe (Arceuthobium americanum) can cause significant growth impact and mortality.

On many h.t.'s throughout the series, Populus tremuloides, a relatively short-lived species, plays an important seral role. On others, it is only a minor seral species or is absent. This species serves as a host for a wide variety of pathogens, particularly stem cankers, rots and foliar diseases. Wood boring insects are also important mortality agents.

The opportunities for timber management in the Abies lasiocarpa series are generally good. However, several h.t.s have very poor possibilities and should be managed for other uses only. Pseudotsuga, Pinus contorta (when present) and Picea (at higher elevations) are all important timber species. When the stand structure is adequate, some h.t.'s may lend themselves well to all-aged silvicultural activities. The clear majority of h.t.'s however are best suited to even-aged management. On most of them a shelterwood appears to be the most realistic method to use to obtain natural regeneration. It also has the advantages of offering site control and protection during the regeneration period, particularly from troublesome brush encroachment and excessive insolation. Small patch or strip clearcuts may additionally be naturally regenerated on several h.t.s. On many more, clearcutting with planting is also feasible. However, proper site pre-

paration and protection from abiotic and biotic influences must always be considered to insure successful regeneration.

In addition to its timber management opportunities, the Abies lasiocarpa series is very important for many other uses. It provides forage for cattle and sheep, as summer range, habitat and food for many species of wildlife, watershed protection and recreation and esthetic opportunities for the area's many surrounding communities and visitors.

KEY TO ABIES LASIOCARPA HABITAT TYPES

1. Juniperus communis at least 5% cover . . . . . ABIES LASIOCARPA/ JUNIPERUS COMMUNIS H.T. (page 12)

1. J. communis less than 5% cover

    2. Vaccinium membranaceum at least 5% cover . . . . . ABIES LASIOCARPA/ VACCINIUM MEMBRANACEU H.T. (page 13)

    2. V. membranaceum less than 5% cover

        3. Vaccinium scoparium at least 5% cover. . . . . ABIES LASIOCARPA/ VACCINIUM SCOPARIUM H.T. (page 15)

        3. V. scoparium less than 5% cover

            4. Physocarpus malvaceus at least 5% cover. . . . . ABIES LASIOCARPA/ PHYSOCARPUS MALVACEUS H.T. (page 17)

            4. P. malvaceus less than 5% cover

                5. Acer glabrum at least 5% cover . . . . ABIES LASIOCARPA/ ACER GLABRUM H.T. (page 19)

                5. A. glabrum less than 5% cover

                    6. Rubus parviflorus at least 5% cover. . . . . ABIES LASIOCARPA/ RUBUS PARVIFLORUS H.T. (page 20)

                    6. R. parviflorus less than 5% cover

                        7. Calamagrostis rubescens at least 5% cover . . . . . ABIES LASIOCARPA/ CALAMAGROSTIS RUBESCENS H.T. (page 21)

                        7. C. rubescens less than 5% cover

                            8. Carex geyeri at least 5% cover. . . . . ABIES LASIOCARPA/ CAREX GEYERI H.T. (page 23)

                            8. C. geyeri less than 5% cover

9. Arnica latifolia at least 5% cover . . . . . ABIES LASIOCARPA/ ARNICA LATIFOLIA H.T. (page 24)

9. A. latifolia less than 5% cover

10. Osmorhiza chilensis at least 5% cover . . . . . ABIES LASIOCARPA/ OSMORHIZA CHILENSIS H.T. (page 26)

10. O. chilensis less than 5% cover

11. At least two of the following four species present with at least 1% cover; Berberis repens, Pachistima myrsinites, Symphoricarpos oreophilus, and Rosa nutkana . . . . . ABIES LASIOCARPA/ BERBERIS REPENS H.T. (page 28)

11. Not as above

12. Ribes montigenum at least 2% cover, Osmorhiza chilensis usually present . . . . . ABIES LASIOCARPA/ RIBES MONTIGENUM H.T. (page 30)

12. R. montigenum less than 2% cover

13. Lathyrus leucanthus at least 5% cover. . ABIES LASIOCARPA/ LATHYRUS LEUCANTHUS H.T. (page 32)

13. L. leucanthus less than 5% cover

14. Pedicularis racemosa at least 5% cover . . . . . ABIES LASIOCARPA/ PEDICULARIS RACEMOSA H.T. (page 34)

14. P. racemosa less than 5% cover

15. Carex rossii at least 5% cover . ABIES LASIOCARPA/ CAREX ROSSII H.T. (page 36)

15. C. rossii less than 5% cover

16. Arnica cordifolia at least 5% cover . . . . . ABIES LASIOCARPA/ ARNICA CORDIFOLIA H.T. (page 37)

16. Not as above: Return to entry number 1 and use 2% instead of 5%, 1% instead of 2%, 1/2% instead of 1%.

Abies lasiocarpa/*Juniperus communis* h.t. (*Abla*/*Juco*)

Abla/*Juco* is a minor h.t. that was found locally near Paris Peak in the Bear River range of Idaho. Although it was not found outside this area, it probably occurs sporadically throughout the Bear River range. This h.t. occupies cold and dry, high elevation sites that are quite exposed and rocky. Sprawling patches of *Juniperus communis* occupy the poorly developed soils that occur among the quartzite outcrops and boulders.

Pseudotsuga menziesii and *Pinus flexilis* were co-dominant on this h.t. with *Abies lasiocarpa* and *Picea engelmannii* also present. Regeneration is quite sporadic and productivity is very low due to the low stocking and poor windy environment for height growth. Wildlife habitat, watershed and esthetic values are very important uses of this h.t.

This h.t. is similar to the *Abla*/*Juco* of East Central Idaho described by Steele *et al*. (1975). In the Wasatch Range, however, it is apparently restricted to the higher elevations.

Abies lasiocarpa/Vaccinium membranaceum h.t. (Abla/Vame)

The Abla/Vame h.t. occurs in the Bear River range, mainly in southern Idaho but occasionally in northern Utah. It is mostly found at the mid subalpine elevations, on cool northerly aspects with moderate slopes.

Picea engelmannii or Pinus contorta are usually the dominant overstory trees in these stands, which usually include a dominant understory of Abies lasiocarpa or Picea. Although Abies and Picea both regenerate relatively well in the understory, Picea will normally dominate due to the high mortality of Abies.

Vaccinium membranaceum is the dominant shrub on this h.t. and is often fairly dense. Pachistima myrsinites was almost always present in small amounts with Arnica latifolia and Pedicularis racemosa being the most frequent forbs.

Soils are clays, clay loams or silty loams. Parent materials are either conglomerates or quartzite. The deeper, more productive soils are formed from the conglomerates; whereas the shallower, usually stony surfaced soils occur with the quartzites.

Timber production is moderate; the site index averages 85 feet. Old growth Picea englemannii usually dominates the upper elevation site and may obtain large dimensions on the better sites. Pinus contorta is very important at the mid-elevations of this h.t., particularly on gentle slopes at lower elevations. Potential frost action, rodent activity and vegetation competition may make even-aged natural regeneration of these species difficult without adequate site preparation. On some sites steeper slopes will be a concern in harvesting. Big game species appear to utilize this h.t. to some extent.

Abla/Vame has not been previously described but considered the equivalent of the Abla/Vagl h.t. described by Pfister et al. (1973) on the Boise National Forest.

Abies lasiocarpa/Vaccinium scoparium h.t. (Abla/Vasc)

Abla/Vasc was found only in the southern Idaho portion of the Bear River range around Copenhagen Basin. It occurred on gentle terrain with north to easterly aspects and at the upper elevations of the Abies lasiocarpa series. In Utah this h.t. is known only from the Uinta Mountains, where it is a major subalpine habitat type (Pfister 1972).

In the Bear River range, Abies lasiocarpa and Picea engelmannii were the only trees found with this h.t. although Pinus contorta occurs with Abla/Vasc in the Uinta Mountains. Since Abies is more susceptible to early mortality, the longer lived Picea will dominate the overstory with Abies usually dominating the understory.

Vaccinium scoparium is the main component of the understory vegetation and forms a low shrub cover. Ribes montigenum is normally present in small amounts. Arnica latifolia, A. cordifolia, Pedicularis racemosa and Achillea millifolium were the most common forbs occurring with this h.t., and Carex rossii was the most frequent graminoid.

Soils are silty clays on flats, or cobbly sandy clays on slopes. Quartzite and quartzitic glacial tills were the only parent materials associated with this h.t. Stony surfaces are often present, particularly on the shallow slope soils. The moderately deep soils on flats often have drainage related problems associated with their clayey textures.

With an average site index of 75 feet, production is only moderate. Picea may reach large dimensions with old age but its stocking is usually only moderate. This often results in a characteristically "open," well-lighted stand condition. Drainage associated problems with clay soils may

be limiting for timber management opportunities. In addition, regeneration difficulties were observed on this h.t. due to vegetation competition, and rodent and frost action.

Abla/Vasc or similar h.t.'s have been described from various locations. In Utah this h.t. has been described in detail by (Pfister 1972).

Abies lasiocarpa/Physocarpus malvaceus h.t. (Abla/Phma)

Abla/Phma occupies cool and moist northerly aspects on lower and middle slopes at the lower elevations of the Abies lasiocarpa series. It is found primarily in the southern end of the Wasatch N. F. and adjacent Uinta N.F., usually on relatively steep slopes. It also occurs sporadically in the Bear River range of northern Utah.

Pseudotsuga menziesii is often dominant on those sites where the upper limit of Psme/Phma overlaps with the lower limit of Abla/Phma. Picea engelmannii was usually present and Abies concolor was occasionally found in those stands dominated by Pseudotsuga.

Physocarpus malvaceus usually dominates the understory with a tall dense cover. Other shrubs found consistently in this h.t. are Sorbus scopulina, Pachistima myrsinites and Amelanchier alnifolia. An assortment of forbs such as Actaea rubra, Osmorhiza chilensis, Arnica cordifolia and Viola adunca are usually found in the openings. Carex geyeri is occasionally present under the shrub cover or in the openings.

Soils are shallow, very cobbly silty clays. Parent materials are generally calcareous colluvium or alluvium. Occasionally quartzite may be the parent material.

Although the productivity of this h.t. is moderate to high with an average site index of 100 feet, management for timber uses are severely limited by the shallow, loose soils, (usually present on steep slopes) and by its usual position above streams. In addition, esthetic values are very

important.

This h.t. has not been previously described and may be restricted to northern Utah.

Abies lasiocarpa/Acer glabrum h.t. (Abla/Acgl)

The Abla/Acgl h.t. is found throughout the Bear River range of southern Idaho and northern Utah, and in the Wellsville Mountains. It occurs at the lower to middle subalpine elevations on cool and moist, north to northeasterly aspects, with moderate slopes.

Abies lasiocarpa usually dominates the overstory in these stands although Pseudotsuga, the only seral conifer associated with Abla/Acgl, will sometimes dominate.

Acer glabrum is normally the most abundant understory shrub with Sorbus scopulina, Symphoricarpos oreophilus and Pachistima myrinites present in varying amounts. A fairly rich assortment of forbs are also present including Osmorhiza chilensis and Thalictrum fendleri.

Soils are silty clays and clay loams derived principally from calcareous colluvial materials. They are moderate in depth and well drained.

Productivity is moderate to high with an average site index of 95 feet. Pseudotsuga does very well on this h.t. However with the complete overstory removal, the likely increase in brush may make natural regeneration difficult. Therefore, Pseudotsuga may establish itself well with the shelterwood method. Soils and some steep slopes however, may present limitations for timber related activities. Deer habitat and esthetic values are particularly important too.

This h.t. is very similar to the Abla/Acgl described by Steele et al. (1975) from Central Idaho.

Abies lasiocarpa/Rubus parviflorus h.t. (Abla/Rupa)

The Abla/Rupa h.t. occurs in the mid portion of the Bear River Range of southern Idaho and northern Utah, and occasionally to the south of the Bear River Range. It normally occupies the cool and moist northerly aspects on moderate to relatively steep slopes. It is restricted to the lower or middle elevations of the Abies lasiocarpa series.

Pseudotsuga menziesii and/or Picea engelmannii may occur with Abies lasiocarpa in various proportionson this h.t.

The shrub cover on these sites is generally dominated by Rubus parviflorus with varying amounts of Lonicera utahensis, Pachistima mysinites and Amelanchier alnifolia. Thalictrum fendleri and Oshmorhiza chilensis were the most common forbs associated with this h.t.

Soils are sandy clays, clays, or loams formed from clacareous or quartzitic materials.

Production is moderate to high on this h.t. because of the good stocking and basal area increment. It has an average site index of 85 feet. Regeneration may be difficult with a complete overstory removal because of the increase in brush. Regeneration methods should favor the seral Pseudotsuga and Picea, but Abies might also be considered as it does exceedingly well on this h.t. Wildlife values, for forage and cover are also important.

The Abla/Rupa h.t. has not been described from any adjacent areas and is apparently restricted to the northern Wasatch mountains.

Abies lasiocarpa/Calamagrostic rubescens h.t. (Abla/Caru)

Abla/Caru occurs on gentle to moderate slopes at the lower subalpine elevations. Although this h.t. occupies a variety of aspects, it was most commonly found on northerly slopes. Abla/Caru was found scattered throughout southern Idaho in theBear River Range and in the Albion and Raft River Mountains of the southern Sawtooth N.F.

Pseudotsuga menziesii and/or Pinus contorta are seral species in this h.t., but Pseudotsuga creates a more persistent stand. Populus tremuloides is present in some stands.

Calamagrostis rubescens is usually well represented in the understory with Carex geyeri and C. Rossii often present in small amounts. The most frequent forbs are usually Arnica cordifolia and Osmorhiza chilensis. Symphoricarpos oreophilus may be found in low amounts. Abla/Bere is often adjacent to Abla/Caru.

Soils are either sandy or silty clays, or loams which usually contain fair amounts of gravel. They are usually moderately deep and are principally formed from metamorphic parent materials.

Productivity is moderate to high depending on stocking. The average site index is 85 feet for this h.t. There appears to be an initial period of rapid height growth for Pinus and Pseudotsuga, which do exceptionally well here. Following a disturbance, however, Calamagrostis usually produces a thick sod layer that will affect all stand establishment activities. Therefore, great care must be exercised with these activities to limit this sod condition. A shelterwood or small clearcuts

with plantings in combination with adequate site preparation appear to be the best regeneration method for this h.t.

Similar h.t.'s have been described from Montana (Pfister, et al. 1974) and Central Idaho (Steele et al., 1975)

Abies lasiocarpa/Carex geyeri h.t. (*Abla/Cage*)

Abla/Cage is a minor h.t. in our area, found scattered in the Bear River range of southern Idaho. It occurred mostly at the middle subalpine elevations on various aspects and slopes.

The most common seral species associated with *Abla/Cage* is *Pseudotsuga menziesii*, although *Pinus contorta* and *Populus tremuloides* were often present.

Carex geyeri usually dominates the herb layer, with a low cover. *Arnica cordifolia*, *Osmorhiza chilensis*, and *Osmorhiza depauperata* are the most common forb associates with *Symphoricarpos oreophilus* and *Prunus virginiana* being the most consistent and abundant shrubs on these sites.

The moderately deep gravelly soils are loams formed principally from quartzite.

Production is moderate with good stocking; the average site index is 75 feet. *Pseudotsuga* and *Pinus* contorta (at higher elevations) do well on this h.t. With significant overstory removal, however, *Carex* and the associated shrubs may increase to create regeneration difficulties. Some site preparation may even be required with the use of the shelterwood method if this potential condition becomes troublesome. Wildlife, particularly deer, appear to utilize this habitat for cover and browse.

Similar h.t.s have been previously described by Pfister *et al.* (1974) and Steele *et al.* (1975).

Abies lasiocarpa/Arnica latifolia h.t. (Abla/Arla)

This h.t. occurred mostly in the Bear River range of Idaho, but was also observed in the southern portion of theWasatch N.F. It usually occupied cool and relatively moist northerly aspects on gentle to moderate slopes.

Abies lasiocarpa and Picea engelmannii are codominant on these sites with Pseudotsuga menziesii being the major seral conifer. Pinus flexilis or Populus tremuloides may occur as accidentals.

Arnica latifolia forms a low forb cover and is usually the most abundant understory plant. Ribes montigenum, Pedicularis racemosa, Pyrola secunda and Carex rossii were almost always present with low coverage.

The soils of this h.t. generally have textures ranging from sandy clays to silty clays. They are usually moderately deep. Small amounts of gravel cobble and surface stones may be present on some sites. Parent materials appear to be principally quartzite although conglomerate was also encountered.

With careful management timber opportunities on the Abla/Arla h.t. are generally good. This h.t. has a moderate level of productivity with an average site index of 75 feet. However some stands of well-stocked old-growth Picea may contain significant volume. On some sites, a major canopy disturbance will create unfavorable seedbed and growth conditions for both natural and artificial regenerative measures. This is particularly true for Picea seedlings. All-aged management for Picea and Abies is usually limited because of the general poor stand structure. On sites where the structure is adequate to permit such management, it may be successful if proper attent-

ion is paid to site preparation and to seedling and residual tree protection from physical damage, rodent and livestock activity, and frost action.

Clearcutting with plantings of Pinus contorta (when it is present) or Picea appears to be the most realistic timber management alternative, but only on those sites with a high probability of success. These cuts must provide protection from excessive insolation to reduce seedling dessication losses. Other site preparation and protection measures are of equal, critical importance.

Stands frequently occupy sites adjacent to areas extensively utilized as summer range by sheep and native wildlife species. Thus the Abla/Arla h.t. is often visited by these animals. To a more limited extent it is also valuable for its esthetic and recreational opportunities.

We have tentatively included the Abla/Arla h.t. in the preliminary classification. The possibility exists that this h.t. consists of parts of the Abla/Rimo and Abla/Pera h.t.s. Further field checking is necessary, particularly on the successional role of Arnica latifolia with this environmental spectrum, to insure its status as a h.t. It has not been previously identified from studies of adjacent areas.

Abies lasiocarpa/Osmorhiza chilensis h.t. (Abla/Osch)

Abla/Osch occurs throughout our study area, but is most common in the Bear River range. It is also fairly common in the Albion and Cassia Divisions of the southern Sawtooth N.F. This h.t. normally occupies relatively moist sites of various aspects at the mid and lower elevations of the subalpine zone.

Populus tremuloides is an important seral tree of this h.t., often dominating the site in early succession. Pinus contorta and/or Pseudotsuga menziesii act as major seral species often in later successional stages. Picea engelmannii is sometimes present, but with relatively low coverage.

Osmorhiza chilensis is uslally well represented among a fairly rich mixture of forbs with Thalictrum fendleri, Stellaria jamesiana and Viola adunca usually present. Carex rossii and Poa nervosa also occur quite regularly in these stands.

The soils of this h.t. may vary widely in texture; sandy clays, silty loams and clays arethe most common. They are also generally moderately deep to deep, fertile, moist and usually show good development. Usually gravel and cobble occur in small amounts and occasionally small stones are on the surface. Parent materials are principally calcareous or quartzitic, but others may also be present.

This h.t.'s timber management opportunities appear to be very good largely because it is generally very productive. It has an average site index of 100 feet and it is usually adequately stocked with the more desirable Pseudotsuga and/or Pinus contorta (when it is present). Our observations indicate that the Abla/Osch h.t. has one of the best basal area increments.

Nevertheless, regeneration difficulties may arise if care is not taken to maintain control of the site. With a significant overstory canopy removal, Populus, when present, often tends to rapidly dominate the site. Brush species, particularly Salix scouleriana, will also increase in coverage further increasing vegetation competition. In addition, any sites with warmer, drier exposures will probably have significant seedling losses associated with insolation and rodent activity. The shelterwood method then appears to work well on this h.t. Clearcutting with planting may also be applicable on those sites that are more protected and larger in area.

Many sites are adjacent to mountain meadows. Thus it frequently serves as an important source of forage and shade for cattle and sheep. Abla/Osch is also important for wildlife habitat, particularly for elk at higher elevations, and watershed cover. Additionally some sites have significant esthetic values and recreation opportunities.

A similar h.t. has been reported by Steele(1974) from the southern Sawtooth N.F.

Abies lasiocarpa/Berberis repens h.t. (Abla/Bere)

The Abla/Bere h.t. is found extensively throughout the Wasatch Range of Utah and Idaho. It is also found in more scattered locations throughout the Malad Range and Raft River Mountains. This h.t. occupies a variety of aspects and slopes in the Wasatch Range, at the upper to middle elevations of the Abies lasiocarpa series. In the Raft River Mountains, it was found only on northerly aspects at the middle subalpine elevations.

Abies concolor, Picea engelmannii, Pinus flexilis and Populus tremuloides may be present on this h.t., but Pseudotsuga menziesii and Pinus contorta are the most frequent and vigorous seral species.

Berberis repens and Pachistima myrsinites are almost always present together, although on many sites Pachistima may be more abundant than Berberis. The reverse is usually true in the Psme/Bere h.t. Symphoricarpos oreophilus and Rosa nutkana are also important indicators of the Abla/Bere h.t. The most frequent forbs of this type are Arnica cordifolia, Osmorhiza chilensis, and Thalictrum fendleri.

Abla/Bere soils vary widely in texture (ranging from sandy loams to clays). Parent materials are principally calcarious. These soils are mostly moderate in depth and usually show some profile development.

The productivity of this h.t. is moderate. It has an average site index of 85 feet. The better sites with deeper, more fertile soils and gentler slopes usually offer very good timber management opportunities. Even-aged management is possible for Pseudotsuga or Pinus contorta (when it is present) Abies lasiocarpa reproduces well here but it is generally a less desireable timber species. Our observations indicate that the shelterwood method, with special considerations for any diseased trees, is a plausible regeneration method.

It would be particularly effective for those stands that are relatively small in area. In addition, patch or strip clearcuts may be possible. These may regenerate naturally but larger ones should probably best be planted to maintain control of the site. Site preparation measures must always be carefully considered.

Several other uses are also important, particularly wildlife, recreation and esthetics. Also, livestock utilize these sites to a limited extent for shade and limited forage.

Pfister (1972) identified this h.t. from our area.

Abies lasiocarpa/Ribes montigenum h.t. (Abla/Rimo)

The Abla/Rimo h.t. was found throughout our area at the upper sub-alpine elevations. It was found most often on moderate upper slopes, but it occasionally occurred on more gentle terrain. This h.t. normally occupies northerly aspects, often those that accumulate deep snow near upper timberline.

In our area Picea engelmannii is normally the dominant overstory tree with Abies mostly dominant in the understory. The Abies in the understory often reproduces by layering, some of which probably results from snow accumulation. Pseudotsuga menziesii and Populus tremuloides were rarely found with this h.t.

Ribes montigenum is usually the dominant and occasionally the only shrub associated with this h.t. Symphoricarpos oreophilus and Lonicera utahensis were often present in varying amounts. Aquilegia caerulea and Stellaria jamesiana were the most consistent forbs occurring on these sites. Graminoides were usually poorly represented, the most frequent being Carex rossii.

The shallow soils of this h.t. are generally poorly developed, with textures that range from coarse sands to the more frequent silty clays. Gravel, cobbles and surface stones are present, usually in moderate amounts. Parent materials are generally calcareous or metamorphic in nature.

Timber production value is only moderate. Productivity islow to moderate, depending largely on aspect. The average site index is only 65 feet, although older Picea may obtain heights of 100 feet on the better sites. However, with a major canopy opening, Picea is very difficult to establish because of the rodent and livestock activities, frost action and insolation

associated with these sites. Plant competition also increases significantly and further reduces the chances for Picea's establishment. Abies reproduces better on this h.t., but is a less desirable timber species.

The Abla/Rimo h.t. serves as important sheep range throughout most of the study area. It is also valuable as cover and forage for elk and deer, and watershed protection.

Pfister (1972) first described this h.t. from our area. It has since been found in southern Montana (Pfister et al. 1974) and in Central Idaho (Steele et al. 1975).

Abies lasiocarpa/Lathyrus leucanthus h.t. (Abla/Lale)

The Abla/Lale h.t. occurs in the Bear River range of northern Utah. It was usually found at the middle subalpine elevations on cooler northerly exposures with moderate relief.

Abies lasiocarpa and Picea engelmannii codominate these stands with Pseudotsuga menziesii often present in a seral capacity.

Lathyrus leucanthus dominates the forb layer with a lush cover. Other forbs usually associated with this type are Osmorhiza chilensis, Arnica cordifolia, Stellaria jamesiana, and Aquilegia caerula. Carex rossii occurred consistently with relatively low coverage.

Soils are generally sandy or silty clays. Moderate amounts of gravel are usually present. Parent materials are conglomerates or quartzitics.

Although this h.t. has an average site index of 80 feet, it generally has a low productivity because of its usually patchy stocking. Stands with better stocking have a more moderate productivity. These then are the only stands that present realistic timber management opportunities. Here even-aged management of Picea (and Pseudotsuga on more moderate sites) may be accomplished with the use of the shelterwood method. This should also serve to reduce the ever present potential increase in vegetation competition, rodent activities and insolation. Livestock (principally sheep) must be excluded from those sites that are being regenerated. An excessive removal of the overstory canopy will most likely result in a loss of the site, even with prompt planting. Most existing stand structures (even-aged) will not

lend themselves to all-aged management.

Most of these stands lie within or near areas extensively used as summer livestock (sheep) range and wildlife habitat. Watershed and esthetic values are also important on particular sites.

This h.t. has not been previously reported.

Abies lasiocarpa/Pedicularis racemosa h.t. (Abla/Pera)

The Abla/Pera h.t. occurs scattered throughout the Bear River range at the upper elevations of the subalpine zone. It occupies a variety of aspects with gentle to moderate relief.

Picea englemannii and Pinus contorta are the major seral conifers on this h.t., with Pseudotsuga occasionally present. Picea is almost always present and apparently regenerates well in these stands. The understory is a mexture of Picea engelmannii and Abies lasiocarpa.

Pedicularis racemosa is the predominate understory plant, often growing in scattered clumps or patches. Arnica cordifolia, Osmorhiza chilensis, Stellaria jamesiana, and Aster engelmannii are the most frequent forbs occurring with Pedicularis. Lonicera utahensis and Pachistima myrsinites are usually present in small amounts.

Soil textures vary from sandy loams to clays. In addition, small amounts of gravel, cobble and surface stones are usually present. Quartzites and conglomerates are the principal parent materials, but sometimes calcareous materials also serve in this capacity.

With an average site index of 80 feet, the productivity of this h. t. is moderate. Pinus contorta, which is usually non-serotinous, appears to do well at lower elevations in this h.t. Thus silvicultural operations should concentrate on this species when it is present in the immediate area. Elsewhere Picea, on cooler sites and possibly Pseudotsuga on warmer sites, should be the principal timber species. Clearcutting with

planting and small clearcut strips or patches which depend on natural seeding from their edges may work at lower elevations in this h.t., but at higher elevations they usually fail. If Arcenthobium americanum is present on Pinus, these methods are the only plausible alternatives. All-aged management for Picea may be possible but is an untested alternative. Most of the stands have patchy structures that do not lend themselves well to regeneration by the shelterwood method. Usually proper site preparation must be undertaken to reduce seedling losses from frost action and rodent activities. In addition, herbaceous vegetation competition may become a critical factor in seedling establishment, particularly on those sites where regeneration has been delayed.

Abla/Pere has not previously been identified elsewhere.

Abies lasiocarpa/Carex rossii h.t. (Abla/Caro)

This h.t. was described by Steele et al. (1974) from the southern Sawtooth N.F. We did not find Abla/Caro in our sampling, but we have included it in our preliminary classification. Further field work isnecessary to determine its presence and significance in this area. In many respects this h.t. appears to be very similar to our Abla/Pera h.t. (P.). Steele, however, found that Pedicularis racemosa was not associated with the Abla/Caro h.t.

Our data for Abla/Pera shows that Pedicularis has an average cover of 11% (Table). Carex rossii has a consistance and average cover of 80% and 4% respectively.

Throughout this study our observations of Carex rossii suggest that with a major canopy disturbance, such a s clearcutting, this species' presence and coverage may increase significantly to the point that it may often become a dominate species on such sites. Thus we feel that it plays a large role in the early plant succession of such areas.

Lyons (1971) reported a similar pattern of behavior for this species on burned Psme/Acgl sites in south-central Idaho. Upon stand closure and subsequent site shading, Carex rossii will probably decrease in importance. At some point Pedicularis, when present, will probably tend to dominate.

Further studies of the roles of Carex and Pedicularis in such situations are recommended.

Abies lasiocarpa/Arnica cordifolia h.t. (Abla/Arco)

The Abla/Arco h.t. occurs scattered throughout the Bear River range of Utah and Idaho. It is mostly found at the middle subalpine elevation on drier northerly aspects with gentle to moderate slopes.

Pinus contorta and Populus tremuloides are the major seral species in Abla/Arco with Picea engelmannii and Pseudotsuga menziesii as minor seral species. Picea engelmannii may co-dominate with Abies lasiocarpa toward climax.

Arnica cordifolia normally dominates an otherwise depauperate understory, which mainly consists of Osmorhiza chilensis, Pachistima myrsinites and Carex rossii.

Soils are generally moderately deep, varying from sandy clay loams to clays. Parent materials are largely quartziferous in nature although conglomerates are also encountered.

The Abla/Arco h.t. has a moderate level of productivity, with an average site index of 80 feet. Pinus contorta's seral dominance and the gentler topography make this h.t. ideally suited for timber management activities. Clearcutting with planting, or smaller clearcut strips or patches that depend on natural seed from the forest edges serve as the principal regeneration methods. Proper site preparation is necessary to reduce competition from vegetation. Also, care must be taken to reduce seedling mortality due to frost action, rodent activities and insolation.

Abies concolor and Abies concolor-Quercus gambelii Series

Abies concolor is a minor series in our area occurring south of the Ogden area in the Wasatch Mountains. It is mostly associated with the Pseudotsuga menziesii in this area. The Abies concolor-Quercus gambelii series represents the dry end of the environmental gradient for the Abies concolor series. Both series frequently occur as lower coniferous timberline

Abies concolor is frequently attacked by porcupines throughout its occurrance in the study area. This utilization of the cambium usually results in a forked tree, spike top, deformed stem, or outright death of the individual tree. Ream (1964) and Cronquist et al. (1972) suggest that damage by porcupines probably plays a very large role in limiting the more northern establishment of Abies concolor. Our observations also support this, particularly near Abies concolor's northernmost occurrance in the Logan Canyon area.

Both series have very little timber production vaoue. Many sites are significantly important for esthetics, recreational uses and watershed protection. Livestock grazing is usually limited on these series but wildlife values are very high.

Abies concolor - *Quercus gambelii*/*Physocarpus malvaceus* h.t. (Abco-Quga/Phma)

This local, minor h.t. occupies the lower, northern slopes of the Wasatch Front canyon mouths east of Salt Lake City. Slopes are moderate to steep and warm and dry. It is generally present below 5800 feet and often represents lower timberline in this area. This h.t. becomes more widespread and common south of our study area.

Abco-Quga/Phma is characterized by a few dominant trees and a moderate number of small *Abies* stems in association with a fairly dense stand of Quercus gambelii. *Acer grandidentatum* is also present as a seral component. At the higher elevations *Pseudotsuga menziesii* occasionally occurs as an accidental. The understory shrub component is dominated by *Physocarpus malvaceus* and *Prunus virginiana*. Perennial forbs are usually absent, but *Carex geyeri* may be present in small amounts.

This h.t. represents the ecotone between the drier, warmer *Quercus gambelii* communities and the moister and cooler Abco/Phma h.t.

Soils are gravelly, silty sands with cobbles derived from colluvial materials of granite and quartzite. Their surfaces are usually stony.

This h.t. is very important for its recreation and esthetic values but watershed protection and wildlife values are also important. It has little or no timber value; *Abies* regeneration was noted to be quite sporadic.

This series (and h.t.) has not been previously reported.

KEY TO ABIES CONCOLOR HABITAT TYPES

1. Physocarpus malvaceus at least 10% cover . . . . . ABIES CONCOLOR/ PHYSOCARPUS MALVACE H.T. (page 41)

1. P. malvaceus less than 10% cover

    2. Carex geyeri at least 5% cover . . . . . ABIES CONCOLOR/ CAREX GEYERI H.T. (page 42)

    2. C. geyeri less than 5% cover

        3. Osmorhiza chilensis at least 10% cover . . . . . ABIES CONCOLOR/ OSMORHIZA CHILENSIS H.T. (page 43)

        3. O. chilensis less than 10% cover

            4. Symphoricarpos oreophilus at least 25% cover. ABIES CONCOLOR/ SYMPHORICARPOS OREOPHILUS H.T. (page 45)

            4. S. oreophilus less than 25% cover

                5. Berberis repens at least 1% cover. . . . ABIES CONCOLOR/ BERBERIS REPENS H.T. (page 46)

                5. Not as above

                Return to entry number 1 and use 10% instead of 25%, 5% instead of 10%, 2% instead of 5%, 1/2% instead of 1%.

Abies concolor/Physocarpus malvaceus h.t. (Abco/Phma)

This h.t. occurs on steep lower to mid slopes with a wide range of explsures that vary from northeasterly to northwesterly. Abco/Phma is found from Ogden south at lower elevations in the Wasatch Mountains.

Abies concolor and Pseudotsuga menziesii, as the major seral tree species, are the conifer species present. Acer grandidentatum and Quercus gambelii to a lesser extent, may also occur as local, seral species.

Physocarpus malvaceus dominates the coverage of the many understory shrub species. On the more fertile sites, Mitella stauropetala, Smilacina racemosa, Disporum trachycarpum and Arnica cordifolia are the principal forbs. Carex geyeri is also usually present, often in moderate amounts.

Soils are generally gravelly, sandy clays or gravelly loams and are always shallow and loose. Cobbles and/or stones are usually present.

This h.t. has a moderate level of productivity. However the steep slopes and loose shallow soils, and the shrub component will limit timber management opportunities. Its esthetic values are high and it also serves as important wildlife habitat.

Abies concolor/Carex geyeri h.t. (Abco/Cage)

Abco/Cage occurs sporadically throughout the canyons east of Salt Lake City at lower to mid elevations. Its slopes, which usually occur above streams, are very steep with northern to northwesterly aspects that are warmer and drier than Abco/Phma's.

Abies concolor and Pseudotsuga menziesii, which serves a major seral role, make up the canopy overstory. Several shrubs occur on this h.t., including Physocarpus malvaceus, which dominates, plus Amelanchier alnifolia, and Pachistima myrsinites. The dominate forbs are Arnica cordifolia, Ozmorhiza chilensis and Mitella stauropetala. Carex geyeri usually occurs in dense patches surrounded by unvegetated litter surface.

Soils are sandy loams derived from quarzitic parent material. They are very cobbly and shallow which makes them easily disturbed. Bedrock is often exposed at the surface and loose stones are quite common.

The productivity of this h.t. is moderate. However, in addition to the slope and soil limitations, deformed stems are very common, greatly reducing the timber value of this h.t. Watershed and esthetic values are correspondingly very important.

Abies concolor/Osmorhiza chilensis h.t. (Abco/Osch)

Abco/Osch can occur on a variety of slope positions but is usually found on very moist soils, with northern exposures. Its elevational range encompasses the middle to upper elevations of the Abies concolor series. This h.t. occurs throughout the middle Wasatch Range from Ogden Canyon to Little Cottonwood Canyon, and further to the south. Abco/Osch probably reaches its most extensive development in the canyons west of Morgan, Utah, but because of the limited access into this area, it has not been sampled there.

Abies concolor dominates the stand with Pseudotsuga menziesii often present. At the upper elevations Abies lasiocarpa may occur as an accidental on moist bottom sites while Acer grandidentatum may be present at lower elevations as a seral species. Many shrubs are present, particularly Physocarpus malvaceus, Amelanchier alnifolia, Prunus virginiana and Pachistima myrsinites. Osmorhiza chilensis dominates the forb component with Mitella stauropetata and Thalictrum fendleri. Elymus glaucus is the principal graminoid.

This h.t. occupies the deepest soils of this series. They are either loams (on slopes) or gravelly sands (on stream side sites). Surface stones are often present.

This is the most productive h.t. of the Abies concolor series. The site index is 95 feet and its basal area stocking is usually good. The more desirable Pseudotsuga may be regenerated by the shelterwood method, which would also serve to reduce vegetation competition. However, this h.t. is more important for its wildlife and esthetic values.

At higher elevations, Abco/Bere may occupy the drier sites adjacent to this h.t. Abco/Phma is often adjacent on steeper slopes with shallower, stonier soils at lower elevations.

Abies concolor/Symphoricarpos oreophilus h.t. (Abco/Syor)

This minor h.t. occurs on moist pockets of soil on dry upper ridges of the higher elevations. Abco/Syor was found on the crest of the Wasatch range east of the Farmington area representing the highest h.t. of this series. Slopes are gentle which allows for significant moisture retention into the dry windy summer months which enables Abies concolor to exist in this relatively harsh environment.

Abies concolor, the only tree species on this h.t. occurs in characteristically open stands. Symphoricarpos oreophilus greatly dominates the understory vegetation. Pachistima myrsinites and Rosa woodsii are also present while Ceanothus velutinus often occurs on the exposed stand margins. Osmorhiza chilensis, Thalictrum fendleri and Bromus marginatus are the principal herbaceous plants.

Soils are loams that have small amounts of gravel. Parent materials are usually metamorphics.

Production on this h.t. is low. Regeneration is very sporadic and a great potential for brush increase is present with any stand disturbance. Watershed values are very imporant, as are esthetic and wildlife habitat uses.

Abies concolor/Berberis repens h.t. (Abco/Bere)

This h.t. varies widely in exposure occurring on warmer and drier northwesterly to easterly upper slope positions. It occupies the mid to upper elevations of the Abies concolor series. However, it may also be found on streamside sites, particularly at lower elevations. It occurs in the middle Wasatch Mountains from Ogden Canyon to Little Cottonwood Canyon, and further to the south. It has also been identified at 8000 feet in Middle Canyon in the Oquirrh Mountains west of Salt Lake City.

In the Wasatch mountains, Abies concolor dominates the stand while Quercus gambelii and Acer grandidentatum are often present as seral species. Pseudotsuga menziesii shares codominance with Abies concolor in the Oquirrh Mountains, but elsewhere Pseudotsuga appears to be clearly seral.

Berberis repens is present with Amelanchier alnifolia and Symphoricarpos oreophilus also frequently occurring. Osmorhiza chilensis, O. occidentalis and Lathyrus leuthanthus are the principal forbs. Carex geyeri may also be present in small amounts.

Soil textures may vary widely, but soils are usually very cobbly and shallow to moderate in depth. Parent materials are colluvial granitics, quartzitics and occasionally calcareous materials.

This h.t. has a moderate level of productivity. Stocking is best on the less cobbly, finer-textured soils, and on sites with a low coverage of Quercus gambelii. An increase in vegetation competition accompanying

the removal of the overstory may become a problem for regeneration. Abco/Bere is utilized by game animals and is valuable for esthetics so these appear to be the best management options.

PINUS FLEXILIS SERIES

The Pinus flexilis series occurs on xeric south facing slopes or windswept ridges. Its best development was on shallow calcareous soils in the Bear River Range. These soils, usually loams or clays, are gravelly and stony.

Pinus flexilis may be the only tree present, but Pseudotsuga is often a climax codominant. Occasionally Abies lasiocarpa or Picea engelmannii occur as accidentals. The understory vegetation is often very similar to the surrounding shrub communities with a fairly diverse assortment of grasses.

Grazing, wildlife, watershed and esthetic values are this series' most important uses. Its timber value is very low since regeneration of Pinus and Pseudotsuga is very sporadic, growth rates are poor, and trees are widely spaced.

KEY TO PINUS FLEXILIS HABITAT TYPES

1. Artemisa tripartita at least 5% cover . . . . . PINUS FLEXILIS/ ARTEMISIA TRIPARTITA H.T. (page 50)

1. A. tripartita less than 5% cover

    2. Cercocarpus ledifolius at least 5% cover and climax . . . . . PINUS FLEXILIS/ CERCOCARPUS LEDIFOLIUS H.T. (page 52)

    2. C. ledifolius less than 5% cover or clearly seral; Berberis repens present . . . . . PINUS FLEXILIS/ BERBERIS REPENS H.T. (page 54)

Pinus flexilis/Artemisia tripartita h.t. (Pifl/Artr)

This minor h.t. occurs mainly on the broad summits on the east side of the Bear River Range in southeastern Idaho. It occurs between elevations of 7000 to 7600 feet, occupying easterly exposures with gentle topography. It is often lower timberline, representing a very xeric, windy environment.

Pinus flexilis is generally codominant with Pseudotsuga menziesii. Both species are long lived with ages of 300 to 500 years not uncommon. These trees generally occur in groups of 4 to 7 individuals creating a patchy, open stand condition.

Artemisia tripartita dominates the patchy ground cover. Also present in significant amounts are Cercocarpus ledifolius and Symphoricarpus oreophilus. Balsamorhiza sagittata and Arenaria congesta dominate the complex forb component. Many grasses are present on this h.t., the principal species being Leucopoa kingii and Agropyron spicatum.

Soils are cobbly sandy clays. Surface stones and cobbles are generally present in moderate amounts. Quartzite is the principal parent material.

The deliquescent growth habit of both tree species is very pronounced. With old age, Pseudotsuga may reach 50 feet and diameters in excess of 40 inches are not uncommon for both species. Regeneration is quite sporatic due largely to seed predation, the environmental regime, and livestock disturbance. Management activities should be for range, wildlife and esthetics.

This h.t. has not previously been recognized. Psme/Bere occurs below on the adjacent, more mesic northern slopes.

Pinus flexilis/Cercoparpus ledifolius h.t. (Pifl/Cele)

Only a reconnaissance was undertaken of this minor h.t.. It occurs in isolated locations in the northern Wasatch Mountains and is mainly centered in the vicinity of Logan Canyon. Pifl/Cele also occurs in scattered locations in the mountain ranges of southeastern Idaho. It can occupy a variety of slope positionsand exposures at middle elevations of the Pinus flexilis series, but it is always associated with very xeric and often windy sites. This h.t. most frequently abuts Cercocarpus ledifolius or mountain brush communities which occupy the more xeric environmental regimes.

Pinus flexilis is the climax tree species of this h.t., but occasionally Pseudotsuga menziesii shares this status. Juniperus scopulorum is sometimes present as an accidental. These trees are characteristically delinquescent in their growth habits and stands often take on a savannah-like appearance.

Cercocarpus ledifolius dominates the shrub layer. Symphoricarpos oreophilus is usually present in canopy openings while Berberis repens tends to occur under shade. Balsamorhiza sagittata, Agropyron spicatum and Leucopoa kingii are usually present in small amounts,

This h.t. is associated with shallow, excessively drained soils derived from calcareous materials. Often, rock outcrops and/or large surface stones are present. Textures are silty clays or silty loams and are gravelly and cobbly.

The timber value of this h.t. is very low. Pifl/Cele is important for its esthetic values, and forage and cover habitat for wildlife, particularly deer.

Steele et al. (1975) reported isolated climax stands of this h.t. in central Idaho.

Pinus flexilis/Berberis repens h.t. (Pifl/Bere)

Pifl/Bere is a minor h.t. and occurs in scattered locations throughout the northern Wasatch Mountains but principally in the Logan Canyon area. It occupies southwesterly to southeasterly exposures on a variety of lower to mid slope positions. These are the more protected, mesic sites of the Pinus flexilis series. As slopes become moister, this h.t. usually gives way to Psme/Bere. On drier slopes it is often adjacent to the mountain brush communities.

Pinus flexilis is the dominant climax tree species with Pseudotsuga menziesii often sharing this status. Other tree species occur as accidentals only. Pifl/Bere stands are characteristically open.

Berberis repens, Pachistima myrsinites and Symphoricarpos oreophilus are the principal shrub species. Artemisia tridentata may also occur in the more open stand interspaces. Cercocarpus ledifolius, when present, is in small amounts or plays a clearly seral role in plant succession. Balsamorhiza sagittata, Leucopoa kingii, and Agropyron spicatum dominate the understory herbaceous species.

Soils are well-drained loams or silty clays derived from calcareous parent materials. Gravel, cobble and stones are always present.

Production for this h.t. is low, but it is the best of the Pinus flexilis series. Stocking is usually poor, and because of the moisture regime, vegetation competition and seed predation, regeneration is quite sporadic. Watershed, forage and wildlife cover are this h.t.'s more

important values.

Steele et al. (1975) notes isolated climax Pinus flexilis stands dominated by Symphoricarpos oreophilus in central Idaho. This h.t. has otherwise not been reported.

PSEUDOTSUGA MENZIESII SERIES

Pstudotsuga occurs throughout our area as both an important seral and climax species. It is a major series throughout the northern Wasatch, Caribou and southern Sawtooth N.F.'s and is partially replaced by the Abies concolor series in the southern Wasatch N.F.

Although the h.t.'s in the Pseudotsuga series lie mainly between 5000 and 8000 feet elevation, Pseudotsuga will often dominate seral stands at higher elevation. It is often co-dominant with A. concolor at lower elevations in the southern Wasatch, merging with A. lasiocarpa in varying proportions at higher elevations. In the Bear River Range, Pseudotsuga is often found in pure stands at its lower elevations due to the near-absence of A. concolor.

The Pseudotsuga series is usually restricted to shady north-facing, moderately steep to steep canyon slopes, but is sometimes found at moderate to high elevations on or near exposed ridges or various aspects.

In this area, Pseudotsuga's principal (but relatively insitnificant) disease is the Douglas-fir dwarf-mistletoe, Arceuthobium douglasii. Trees on steep slopes often have "butt sweep" which probably reflects the shallow and loose soils and active snow creep of these slopes.

Limited timber management opportunities are present on the lower elevation h.t.'s of this series that have steep, loose soils (e.g., Psme/Phma). Regeneration is difficult because of the relative harshness (warm and dry) of this lower montane environment. In addition, an overstory

removal usually results in a rapid, complete dominance of the site by understory shrub species (e.g., Physocarpus, Acer). In our area then, these h.t.'s better serve the uses of wildlife cover and browse, watershed protection and esthetics.

The mid to upper montane h.t.'s of this series (e.g., Psme/Osch) have better timber management opportunities. Pseudotsuga regeneration is generally more successful in this more moderate environment. The necessity of site protection from brush, which often increases with a major canopy disturbance, makes the shelterwood method recommended. However, other values and uses are at least equally important. These include watershed protection, recreation and esthetic opportunities habitat and food for many species of wildlife and to a more limited extent, forage for livestock.

KEY TO PSEUDOTSUGA MENZIESII HABITAT TYPES

1. Physocarpus malvaceus at least 10% cover . . . . . PSEUDOTSUGA MENZIESII/ PHYSOCARPUS MALVACEUS H. T. (page 60)

1. P. malvaceus less than 10% cover and usually absent

    2. Calamagrostis rubescens at least 5% cover . . . PSEUDOTSUGA MENZIESII/ CALAMAGROSTIS RUBESCENS H.T. (page 62)

    2. C. rubescens less than 5% cover

        3. Acer glabrum at least 5% cover . . . . . PSEUDOTSUGA MENZIESII/ ACER GLABRUM H.T. (page 64)

        3. A. glabrum less than 5% cover

            4. Carex geyeri at least 5% cover . . . . . PSEUDOTSUGA MENZIESII/ CAREX GEYERI H.T. (page 66)

            4. C. geyeri less than 5% cover

                5. Cercocarpus ledifolius at least 5% cover and climax . . . . . PSEUDOTSUGA MENZIESII/ CERCOCARPUS LEDIFOLIUS H. (page 68)

                5. C. ledifolius less than 5% or clearly seral

                    6. Osmorhiza chilensis at least 5% cover. . . . . PSEUDOTSUGA MENZIESII/ OSMORHIZA CHILENSIS H.T. (page 69)

                    6. O. chilensis less than 5% cover

                        7. Symphoricarpos oreophilus and Ribes montigenum present . . PSEUDOTSUGA MENZIESII/ SYMPHORICARPOS OREOPHILUS-RIBES MONTIGENUM H.T. (page 71)

                        7. Not as above.

8. Berberis repens or Pachistima myrsinites at least 1% cover . . . . . PSEUDOTSUGA MENZIESII/ BERBERIS REPENS H.T. (page 72)

8. Not as above

9. Arnica cordifolia at least 5% cover . . . . . PSEUDOTSUGA MENZIESII/ ARNICA CORDIFOLIA H.T. (page 74)

9. Not as above.

Return to entry number 1 and use 5% instead of 10%, 2% instead of 5%, 1% instead of 2%, 1/2% instead of 1%.

Pseudotsuga menziesii/Physocarpus malvaceus h.t. (Psme/Phma)

The Psme/Phma h.t. is usually restricted to steep slopes and shaded northerly aspects at the lower to mid elevations of the Pseudotsuga series. This h.t. is quite common in the Utah portion of the Bear River Range and less common in the Idaho part of the range. It also occurs in the Willard Peak area and in the Black Pine and Sublette Mountains of the southern Sawtooth N.F.

Pseudotsuga is the dominant and often the only tree on these sites. Acer grandidentatum, Juniperus scopulorum and Populus tremuloides are occasionally found with low coverage.

The Psme/Phma h.t. is characterized by a tall, dense layer of Physocarpus malvaceus in the understory. Other shrubs that consistently occur with this h.t. are Prunus virginiana, Amelanchier alnifolia, Pachistima myrsinites, Berberis repens and Symphoricarpos oreophilus. The forb component is fairly diverse and includes Arnica cordifolia, Smilacina racemosa, Disporum trachycarpum, Mitella stauropetala and Stellaria jamesiana. On some sites, Carex geyeri is abundant in the openings and under the shrub layer.

Soils are characteristically silty or clayey loams. They usually have a moderate cobble content and small amounts of gravel. These soils are formed from calcareous colluvial parent materials and appear to be very fertile. They are, however, very easily disturbed and displaced, due largely to their steep slopes.

With an average site index of 90 feet the productivity is moderate to high, depending on stocking. However, with a major canopy disturbance, brush species may increase to the point where it will be very difficult to obtain adequate regeneration. The steep slopes, fragile soils and esthetic values of this h.t. further serve to limit any timber uses. In addition, this h.t. appears to be very important for cover and browse for deer during all seasons.

Most all of the Psme/Phma stands throughout the study area are second growth, the original stands having been removed during the initial period of settlement.

Pseudotsuga menziessi/Calamagrostis rubescens h.t. (Psme/Caru)

Psme/Caru was found in the Malad Range of the Caribou N.F. and in the Sublette and Raft River Mountains of the southern Sawtooth N.F. It normally occupies mid to upper slopes having moderate relief. Although Psme/Caru may occupy various aspects, it was mostly restricted to cool and dry northerly slopes in our area.

Pseudotsuga is normally the only conifer on this h.t., but occasionally Pinus contorta is present as a minor seral tree.

Trees tend to be well spaced and with the grassy cover create a park-like appearance. Populus tremuloides is also occasionally present in relatively low amounts, and was obviously dying out in our sample plots. In this respect, it may serve an important seral role in this h.t.

Calamagrostis rubescens dominates the forest floor with a nearly complete grass cover. A few shrubs, such as Berberis repens, Pachystima myrsinites, or Symphoricarpos oreophilus are often present in various amounts.

Soils are generally coarse-textured loams or clays derived from a variety of parent materials such as calcarics or metamorphics. Gravels, cobbles and surface stones are usually absent, or are present in small amounts only. These soils appear to be fertile but are usually dry during most of the growing season.

This habitat type has a moderate level of productivity; the average site index is 90 feet. With complete overstory removal, regeneration may be difficult to obtain because of the moisture regime and the Calamagrostis sod layer. If Ceanothus seed is present, as well as those of other brush

species, a complete overstory removal will tend to favor the development of dense brush fields, particularly with any burning of the site (Lyon 1971). Arceuthobium douglasii was noted in moderate amounts on some plots. Therefore, a shelterwood method, applied in relation to the presence of dwarf-mistletoe, is probably the best means for achieving natural regeneration. Adequate site preparation (scalping), in relation to the Calamagrostis sod layer, may be necessary on many sites.

Utilization of this habitat type by cattle was observed, more so than on any other Pseudotsuga h.t.s. Their presence and disturbance of the Calamagrostis sod allows for an increase in the presence of weedy annuals, as noted by Steele, et al. (1974).

Pseudotsuga menziessi/Acer glabrum h.t. (Psem/Acgl)

The Psme/Acgl h.t. occurs mainly in the Bear River Range of Utah and Idaho and in the Wellsville Mountains. It usually occupies the cool and very moist northerly aspects at the mid elevations of the Pseudotsuga series. Slopes are generally moderate to steep.

In our area there are no seral conifers other than Pseudotsuga associated with this h.t. Normally there is a well-developed Pseudotsuga canopy with Juniperus scopulorum, Acer grandidentatum, or Populus tremuloides in the understory as accidental species.

A layer of tall shrubs dominates the understory vegetation. These include Acer glabrum and usually Prunus virginiana, Amelanchier alnifolia and Symphoricarpos oreophilus. Toward climax, Acer glabrum becomes the dominant shrub. A fairly diverse assemblage of forbs are usually found beneath the shrub layer. In some stands Carex geyeri is present and fairly abundant.

Soils of this h.t. are usually well-drained, coarse textured loams or clays which often include fair to moderate amounts of gravel and surface stones. Parent materials are generally calcareous colluvium. These soils appear to be very fertile, but are probably not very stable.

Its average site index of 90 feet and usual good stocking makes this h.t. very productive. However, an increase in brush following an overstory removal and certain steep slopes may present significant limitations for timber uses. Most of the trees have "butt sweep."

Wildlife, particularly deer, utilize this h.t. during all seasons for both cover and browse.

Pseudotsuga menziesii/Carex geyerii h.t. (Psme/Cage)

Psme/Cage occurs on fairly cool and dry northerly aspects with moderate to steep slopes, normally at the mid to upper elevations of the Pseudotsuga series. This h.t. is found occasionally in the Bear River Range of Utah and Idaho. It also occurs in the Stansbury Mountains and in the Albion Mountains of the southern Sawtooth N.F.

Carex geyeri is normally dominant over a fairly depauperate understory. Berberis repens, Symphoricarpos oreophilus and Amelanchier alnifolia are the most frequent shrubs encountered, with Arnica cordifolia and Osmorhiza chilensis the most common forbs. Calamagrostis rubescens is often present, but in small amounts.

There are usually no seral conifers other than Pseudotsuga associated with this h.t., although Pinus contorta may occur as an accidental. Populus tremuloides is often present but in relatively low amounts.

Soils are generally silty or clayey loams with fair amounts of gravel common. Parent materials are usually calcareous or quartzitic in nature. These soils are shallow to only moderately deep.

Productivity for this h.t. is moderate; its average site index is 80 feet. Management considerations must include the steep slopes and the response of Carex geyeri to overstory removal. On some sites, Carex might increase to the point of forming a regeneration inhibiting sod layer. A light infection of Arcenthobium douglasii, if present, must also be considered. The shelterwood method, with adequate site preparation appears to be the best method for achieving natural regeneration.

Psme/Cage frequently borders areas utilized by cattle. Their occurrence on this h.t. is limited to the sites with gentle slopes where some utilization of shade and low amounts of palatable forage occur. This h.t. is also very important for wildlife cover and forage, particularly deer.

Pseudotsuga menziesii/Cercocarpus ledifolius h.t. (Psme/Cele)

Psme/Cele occurs primarily in the Bear River Range of Utah and Idaho but was also observed in the southern Sawtooth N.F. It occupies warm and dry, south to westerly exposures, or xeric northerly aspects throughout the Pseudotsuga series. This h.t. often borders the more xeric Cercocarpus ledifolius or mixed shrub communities described by Ream (1964).

Pseudotsuga is usually the only tree present, although Pinus flexilis as a seral species, or Juniperus scopulorum as an accidental, may occur here. Trees are widely spaced and often create a savanna-like appearance.

A thick layer of Cercocarpus ledifolius and shrubs such as Symphoricarpos oreophilus dominate the understory. Agropyron spicatum, Leucopoa kingii, and Balsamorhiza sagittata are also usually present.

Soils are excessively well drained loams or silty clays that have a high content of gravel. In addition, cobbles and surface stones are usually present. Most of these soils have calcareous parent materials, although metamorphics may also serve in this capacity.

The timber productivity of this h.t. is low. It best serves the very important uses of watershed protection, forage and cover for wildlife, particularly deer.

Pseudotsuga menziesii/Osmorhiza chilensis h.t. (Psme/Osch)

The Psme/Osch h.t. in our area occurs mostly in the Bear River Range of Utah and Idaho. It is also found in the Wellsville Mountains and in the Albion and Black Pine Mountains of the southern Sawtooth N.F. This h.t. usually occupies cool and moist northerly aspects on moderate to steep slopes at the lower or moderate elevations of the Pseudotsuga zone.

Pseudotsuga is usually the only conifer on these sites, although Abies lasiocarpa or Pinus contorta may occur as accidentals. Acer grandidentatum is a common understory tree and Juniperus scopulorum is sometimes present.

Osmorhiza chilensis dominates a rich forb mixture which usually includes Smilacina racemosa, Arnica cordifolia, Thalictrum fendleri, Geranium fremontii, Silene menziesii and Galium boreale. Circea pacifica and Galium aparine were found in abundance on apparently disturbed sites.

Seral shrubs associated with Psme/Osch include Prunus virginiana, Amelanchier alnifolia and Symphoricarpos oreophilus.

The soils of this h.t. are moderate to fairly deep. They appear to be the most fertile and best developed of any of the Pseudotsuga series. They have textures varying from sandy clay loams to silty clays. Gravel, when present, occurs only in small amounts. Parent materials are either calcareous or quartzitic.

This h.t. has a moderate to high level of productivity; Pseudotsuga appears to do very well here. The h.t. has an average site index of 90 feet and as a general rule it is well stocked. With a complete overstory

removal, natural regeneration may be difficult to obtain on some of the more floristically rich sites because of the competition from the increased shrubs and graminoids. The shelterwood method, then, with adequate site preparation and grazing control, should lend itself well to regenerating this h.t.

Light use of this h.t. by cattle for forage and shade was noted. This value depends largely on the site's location with respect to other areas of significant utilization (e.g., meadows and gentler slopes). Generally, an increase in weedy plant species accompanies significant disturbances of these sites. In addition, some utilization of this h.t. by wildlife species was observed.

Pseudotsuga menziesii/Symphoricarpos oreophilus-Ribes montigenum h.t. (Psme/Syor-Rimo)

Psme/Syor-Rimo occurs mostly in the Bear River Range of Utah and Idaho and in the Wellsville Mountains. It occupies cool and dry westerly aspects on moderate to steep slopes at the highest, most exposed elevations of the Pseudotsuga series.

Pseudotsuga is the dominant tree on this habitat type although Pinus flexilis is often present and co-dominant. Both trees are characteristically open-grown in appearance. Large diameters of 30-plus inches and ages of 300-plus years are not common.

Symphoricarpos oreophilus and Ribes montigenum are always present together, with Artemisia tridentata usually occurring in the larger openings. This is the only h.t. of the Pseudotsuga series in which Ribes montigenum was observed. Leucopoa kingii, Stellaria jamesiana and Senecio streptanthifolius were consistently present in varying amounts.

The shallow, well-drained soils include a wide variety of gravelly textures with sandy or silty clays and loams being the most common. Cobbles and stones frequently dominate the soil matrix, and surface stones are usually present.

The timber value of this h.t. is very low because of its poor stocking, sporadic regeneration and low site index (although massive diameters of 40-plus inches are occasionally encountered). Watershed, esthetics and wildlife values are the critical management considerations.

Pseudotsuga menziesii/Berberis repens h.t. (Psme/Bere)

The Psme/Bere h.t. is found throughout the northern mountains, especially in the Bear River Range. It is also found in the Black Pine and Sublette Mountains of the southern Sawtooth N.F. This h.t. occupies a variety of slopes and aspects that are cool and dry.

Pseudotsuga may be the only conifer present, but Abies lasiocarpa, Abies concolor, Picea engelmannii or Pinus flexilis can occur as accidentals where their distributional and altitudinal ranges overlap with this h.t. Juniperus scopulorum or Acer grandidentatum are occasionally present in the understory. Populus tremuloides sometimes occurs on these sites in a seral capacity.

Berberis repens is usually the most conspicuous shrub, but Pachistima myrsinites and Symphoricarpos oreophilus are normally quite abundant. Prunus virginiana and Amelanchier alnifolia occasionally occur in relatively large amounts. Arnica cordifolia, Smilacina racemosa, Stellaria jamesiana and Poa nervosa are also frequent associates of this h.t.

This h.t. is found in the shallow, drier soils that generally have silty or clayey loam textures. Gravel, cobble and some surface stones are usually present. A great variety of parent materials appear to be present.

The timber productivity for this h.t. is generally moderate. Significant differences in site index values (average=70 feet) may occur throughout its broad environmental range. These mainly appear to be a function of the individual site's exposure and its soil development.

Several factors strongly suggest the use of the shelterwood method to regenerate the Psme/Bere h.t. Many two-storied stands containing younger, intermediate or suppressed trees were observed throughout the study area. Also, a complete overstory canopy removal on many sites (particularly the drier ones) was noted to have led to difficulties in obtaining natural regeneration. In addition, Arceuthobium douglasii may be locally present in light to moderate amounts. Its occurrence will modify the shelterwood method by mandating the removal of any infected trees with the first cut.

This h.t. also serves as important wildlife habitat for a variety of species. Deer appear to utilize these sites for cover and browse when Amelanchier or Prunus is present.

This h.t. is similar to the Psme/Bere described by Steele (1974).

Pseudotsuga menziesii/Arnica cordifolia (Psme/Arco)

Psme/Arco is a minor h.t. in our area that was only found in the Right Fork of Logan Canyon, although it probably occurs in other widely scattered locations of the Bear River Range. Pseudotsuga was the only conifer found with this h.t. Arnica cordifolia dominated an otherwise depauperate understory with a few small patches of Symphoricarpos oreophilus and Amelanchier alnifolia.

The soil is a sandy loam with a moderate amount of rounded calcareous gravel present. Our plot had a good stocking of pole-sized trees and its extrapolated site index is 80 feet. Thus, the productivity appears to be moderate. Utilization of the site by big game species (elk and deer) was also observed.

Populus tremuloides communities

Populus tremuloides is a seral species that is quite extensive throughout our area. It occurs in varying proportions with most h.t.'s in the Pseudotsuga menziesii and Abies lasiocarpa series, but is less often found with h.t.'s in the Abies concolor series.

Populus often forms pure stands but may dominate a community of smaller shrubs or trees such as Acer grandidentatum. It is frequently found in a seral condition dominating a site with Pseudotsuga or A. lasiocarpa reproducing in the understory. However, many of the P. tremuloides stands have such a lush understory growth that conifer seedlings are apparently prevented from establishing.

Following a disturbance such as logging, fire or avalanche, Populus will often become dominant, acting as a pioneer tree. This does not mean that these stands only occupy previously disturbed areas since it has been observed as a self-perpetuating species on some sites.

Normally Populus is clearly seral to A. lasiocarpa, A. concolor or Pseudotsuga, although it has been shown that Populus does function as the climax species on certain sites. Pfister (1972) suggests that Populus climax sites represent an adaphic climax in which soils and climate are sufficient to maintain the abundant understory vegetation that inhibits coniferous seedling establishment.

The luxuriant understory vegetation is usually characterized by a shrub layer and a dense forb or grass cover. In our area Prunus virginiana and Symphoricarpos oreophilus are the most common shrubs associated with Populus and Thalictrum fendleri, Lathyrus leucanthus, Agastache urticifolia, Rudbeckia occidentalis and Senecio serra are typical forbs. In Little Cottonwood Canyon near Salt Lake City, Pteridium aquilinum completely dominated the understory vegetation in some stands associated with frequent avalanches. The most abundant grasses occurring with Populus in our area are Elymus glaucus and Bromus marginatus. In stands that have been grazed, Dactylis glomerata and Poa pratensis are sometimes present.

There are numerous diseases and insects that attack Populus including various rots, stem cankers, wood boring insects and foliar diseases and insects.

The Populus community types are used extensively for forage by cattle and sheep and by wildlife species. Several major campgrounds are located here as well as many winter recreational activities. Travelers daily view the numerous acres of Populus that lie adjacent to mountain highways. In addition, because of its extensive occurrance in our area, it serves the very important function of watershed cover.

Quercus gambelii and Acer grandidentatum communities

Quercus gambelii occurs in the southern half of the Wasatch Range usually at elevations between 5500 and 7500 feet. It normally occupies dry positions of various aspects and slopes.

The distribution of Quercus gambelii terminates rather abruptly near Willard Peak and just barely crosses the southern border of Cache County. At this northern limit it is apparently reproducing vegetatively only.

Within the distributional and elevational limits of Quercus gambelii, Acer grandidentatum is usually co-dominant with Quercus. North of Willard Peak, however, Acer dominates the canyon bottoms and ravines, below the Pseudotsuga series. Acer apparently reaches its best development in the Wellsville mountains of northern Utah, where it forms dense thickets over large areas.

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APPENDIX

The Habitat type concept.

Field methods.

Office methods.

Occurrence and roles of tree species and average site index by habitat type.

Constancy and average cover of important species by habitat type.

The Habitat Type Concept

Development of this habitat type classification follows the general concepts expressed by the Daubenmires (1968) with minor modification. Our primary emphasis has been on environmental stratification (habitat types) rather than a precise and complete description of plant associations at climax. Thus, our sampling has included a large proportion of nearly mature stands that have not yet achieved climax or near-climax status. With the stand table data, the climax tree species can be predicted; also we have assumed that the understory vegetation beneath a mature canopy approximates climax composition and dominance. To avoid misunderstanding, our definitions and concepts are expressed below.

Plant community is a unit of vegetation recognized by both overstory and understory dominants, which is homogeneous with respect to species composition, age and structure. Notwithstanding ecotones it is a concrete entity which can be delineated and recognized in the field.

Plant community type is an aggregation of similar plant communities into a set or type. It thus represents an abstraction or average of several real communities where no one community is likely to be exactly like the community type.

Climax plant community type is those and only those plant community types which are regarded as climax or at least where there is no evidence that succession to another community is occurring or could occur.

Habitat type is the aggregate of all units of land capable of supporting a single climax plant community type. The climax community type provides the logical name for the habitat type, e.g., Abies lasiocarpa/Carex geyeri. The first part of this binomial is the most shade tolerant tree

species adapted to the site. The second part of the name is based on the dominant or characteristic undergrowth species in the climax community.

The climax plant community reflects the most meaningful integration of the environmental factors affecting vegetation. As such, each habitat type represents a relatively narrow, although sometimes arbitrarily defined, segment of environmental variation and thus delineates a certain potential for vegetal development. One habitat type may support a variety of disturbance-induced or seral, plant communities but the succession within one habitat type will ultimately produce similar plant communities at climax.

Use of climax community types to name habitat type does not imply that we have an abundance of climax vegetation in the present landscape. Actually, most vegetation in the landscape reflects some form of disturbance. Habitat type names do not imply that we are managing for climax vegetation. In most cases, seral species are the most productive. Furthermore, this method does not require the presence of a climax stand of identify the habitat type. It can be identified during most stages of succession by comparing the relative reproductive success of the species present with known successional trends and by noting the vegetation on similar sites nearby.

Not all units of land will fit neatly into the habitat type system. As in most biological classifications, integrades, or hybrid stands, are inevitable. These situations do not detract from the habitat type classification system.

The utility of habitat types in forest management is that they provide a permanent and ecologically sound system of land stratification. Each habitat type encompasses a certain amount of environmental variation but the variation within a particular habitat type should be less than between types. Thus plant succession can be predicted for each habitat type and a similar response to management treatments can be expected on all units of land within the same type.

Field Methods

Mature stands were sampled at selected locations throughout the Wasatch and southern part of the Caribou National Forests in an attempt to sample a full range of environmental conditions. Sampling was conducted on temporary 375 m^2 (0.092 acre) circular plots, referenced for possible revisitation during conduct of the study. In each plot, every tree species was tallied by 2-inch DBH classes, amounts of all plant species were estimated by percent canopy-coverage and at least one relatively free-growing tree of each species present was measured for height, age, and DBH in order to estimate site potential for each tree species. Observations were made on fire history, insect and disease occurrence, animal use, and position of the stand in relation to adjoining habitats. Soil samples were collected from the upper 2 decimeters (8 inches).

Office Methods

Following completion of the field work, several steps were involved in developing the preliminary classification.

Step 1 - Subjective, first approximation - Immediately following the field season, we constructed a first approximation of possible types based on our field observations. Pfister's (1972) types and the preliminary central Idaho types (Steele et al., 1973b) that had been encountered were listed. New situations, not meeting these previous descriptions, were described briefly and given tentative names. This process resulted in identification of over 50 possible habitat types or phases.

Step 2 - Plant identification and coding - An attempt was made to identify all plants on each sample plot. Collected plants in flower were identified and sent through appropriate channels for verification. Unknown vegetative material was compared with previously identified flowering specimens. By March 1976, species identification and verification had been completed to the point that vegetation data analyses could be conducted. Each species with occurrence in five or more stands was numerically coded. All plot data are being key-punched for computer processing

Step 3 - Type delineation - The key vegetational parameters for these types and phases were identified and briefly described. From this a key to the habitat types was constructed. This key was then applied to all plot data on hand. The resulting delineations were compared with the existing classification in adjacent areas (Pfister, 1972; Pfister et al., 1972, 1973a, 1973b) to insure an adequate merger of the classification system.

Step 4 - Verification and adjustments - All sample stands used in the analyses were

then checked against the key and the type descriptions. Several revisions in the type descriptions and key were made to accommodate the actual stand data. Constancy and average cover values were calculated for the important indicator plants following these adjustments (Table II).

Step 5 - Taxonomy of habitat types and phases - Terminology for the types was adjusted to compare as directly as possible with the Daubenmires' (1968) system, with Steele et al. (1973a) and Pfister (1972). The phase was not used at this time in this preliminary classification. With further work phases will undoubtedly be identified.

Step 6 - Type descriptions - A brief synopsis was preapred for each defined habitat type, highlighting key characteristics of the type. This includes a generalized description of the physical environmental features and relative positions of the habitats, key vegetational features, and some implications for management.

TABLE I.-OCCURRENCE AND ROLES OF TREE SPECIES AND AVERAGE SITE INDEX BY HABITAT TYPES

Code to symbols used for status in forest succession: C=major climax species; c=minor climax species; S=major seral species; s=minor seral species; a=accidentals; ()=in certain areas of the habitat type.

HABITAT TYPE	AVERAGE SITE INDEX (FEET)[1]	Quga	Acgr	Jusc	Abco	Psme	Pifl	Potr	Abla	Pipu	Pico	Pien
Abco-Quga/Phma	54	C	c	.	C	.	.	.	.	.	.	.
Abco/Phma	75	(s)	s	.	C	S	.	(s)	.	.	.	.
Abco/Cage	65	.	.	.	C	S	.	.	.	.	.	.
Abco/Osch	95	.	s	.	C	S	.	.	a	.	.	.
Abco/Syor	55	.	.	.	C	.	.	.	.	.	.	.
Abco/Bere	70	s	S	.	C	S	.	(s)	.	.	.	.
Psme/Phma	90	.	s	a	(a)	C	.	(s)	a	.	(a)	.
Psme/Caru	90	.	s	.	.	C	.	S	.	.	s	.
Psme/Acgl	90	.	s	a	(a)	C	.	s	a	.	.	.
Psme/Cage	80	.	a	.	.	C	.	s	a	.	(a)	.
Psme/Cele	45	.	a	a	.	C	S	.	a	.	.	.
Psme/Osch	90	.	S	a	.	C	.	s	.	.	(a)	.
Psme/Syor-Rimo	55	.	.	.	.	C	c	.	a	.	.	a
Psme/Bere	70	.	s	a	(a)	C	a	s	a	.	.	a
Psme/Arco	80	.	.	.	.	C	.	.	.	.	.	.

[1]Base age 100 years.

TABLE 1.-CONT.

HABITAT TYPE	AVERAGE SITE INDEX (FEET)	Quga	Acgr	Jusc	Abco	Psme	Pifl	Potr	Abla	Pipu	Pico	Pien
Pifl/Artr	23	.	.	.	.	C	C	.	.	.	.	.
Pifl/Bere	55	.	.	.	.	c	C	.	.	.	.	.
Abla/Juco	35	.	.	.	.	c	c	.	C	.	.	s
Abla/Vame	85	.	.	.	.	s	.	.	C	.	S	C
Abla/Vasc	75	.	.	.	.	.	.	.	C	.	.	C
Abla/Phma	100	.	a	.	a	S	.	s	C	a	.	s
Abla/Acgl	95	.	s	.	.	S	.	.	C	.	.	.
Abla/Rupa	85	.	.	.	(a)	S	a	s	C	.	.	s
Abla/Caru	85	.	s	.	.	S	.	s	C	.	S	a
Abla/Cage	75	.	a	a	.	S	.	s	C	.	s	a
Abla/Arla	75	.	.	.	.	s	a	s	C	.	.	c
Abla/Osch	100	.	.	.	.	S	.	S	C	.	(s)	s
Abla/Bere	85	.	a	.	(a)	S	s	S	C	.	S	S
Abla/Rimo	65	.	.	.	.	s	a	s	C	.	.	c
Abla/Lale	80	.	.	.	.	s	.	.	C	.	.	c
Abla/Pera	80	.	.	.	.	s	.	.	C	.	s	C
Abla/Arco	80	.	.	.	.	s	.	S	C	.	S	s

TABLE II - CONSTANCY AND (AVERAGE COVERAGE %) OF IMPORTANT SPECIES

SERIES	Abco-Quga	Abies concolor					Pseudotsuga menziesii		
HABITAT TYPE	Phma	Phma	Cage	Osch	Syor	Bere	Phma	Caru	Acgl
NO. OF STANDS	n=3	n=6	n=1	n=4	n=1	n=6	n=39	n=4	n=13
TREES									
Abies concolor	10(41)	10(50)	10(64)	10(77)	10(55)	10(61)	1(1)	.	1
Abies lasiocarpa	.	.	.	5(9)	.	.	1(2)	2(7)	3
Acer grandidentatum	10(47)	5(27)	.	5(20)	.	7(22)	5(11)	.	2(3)
Juniperus scopulorum	.	2	.	.	.	.	3(3)	.	1
Picea engelmannii	.	.	.	.	.	2(1)	.	.	.
Picea pungens	.	.	.	.	.	.	.	.	.
Pinus contorta	.	.	.	.	.	.	+(3)	2	.
Pinus flexilis	.	.	.	.	.	.	.	.	.
Populus tremuloides	.	2(8)	.	.	.	2(1)	2(4)	7(10)	2
Pseudotsuga menziesii	.	10(31)	10(36)	7(18)	.	3(32)	10(68)	10(82)	10(74)
Quercus gambelii	10(73)	3(12)	.	.	.	5(8)	.	.	.
SHRUBS									
Acer glabrum	.	2(3)	.	2(6)	.	2(2)	4(14)	7(4)	10(22)
Amelanchier alnifolia	10(2)	10(15)	10(3)	10(13)	.	7(4)	8(11)	7(5)	8(10)
Artemisia tridentata	.	.	.	.	.	.	.	.	.
Artemisia tripartita	.	.	.	.	.	.	.	.	.
Berberis repens	7(2)	10(3)	.	5	.	10(11)	8(3)	10	8(2)
Ceanothus velutinus	.	.	.	.	10(25)	.	1(4)	.	.
Cercocarpus ledifolius	.	.	.	.	.	2(7)	1(2)	.	1(1)
Clematis columbiana	.	2(2)	.	2(1)	.	.	3(2)	.	3(2)
Clematis pseudoalpina	.	.	.	.	.	.	1(1)	.	2(3)
Juniperus communis	.	.	.	.	.	.	.	.	.
Lonicera involucrata	.	.	.	2(2)	.	.	.	.	2(1)
Lonicera utahensis	.	.	.	2(1)	.	3(1)	+(1)	.	1(1)
Pachistima myrsinites	3(5)	10(18)	10(2)	10(2)	10(10)	5(3)	9(4)	10(2)	9(13)
Physocarpus malvaceus	10(52)	10(44)	10(5)	7(7)	.	7(4)	10(70)	2(1)	2(4)
Prunus virginiana	10(20)	8(5)	10	7(5)	.	5(8)	7(13)	5(2)	8(6)
Ribes montigenum	.	.	.	.	.	.	.	.	.
Ribes viscosissimum	.	.	10	5	.	.	1(4)	2(6)	4(2)
Rosa spp.	3(2)	7(2)	.	.	10(1)	5(1)	6(2)	7	8(3)
Rubus leucodermis	.	.	10	2(1)	.	.	.	.	2(14)
Rubus parviflorus	.	.	.	5	.	.	1	.	3(6)
Sambucus racemosa	7(4)	.	.	.	.	2(2)	.	.	1
Shepherdia canadensis	.	.	.	.	.	.	1	2(2)	1(3)
Sorbus scopulina	.	2(3)	.	2(5)	10(2)	.	1(3)	2(1)	5(8)
Symphoricarpos oreophilus	.	10(5)	10(1)	5(4)	10(60)	7(8)	8(4)	10(3)	8(5)
Vaccinium membranaceum	.	.	.	.	.	.	.	.	.
Vaccinium scoparium	.	.	.	.	.	.	.	.	.

Code to Constancy Values: + = 0-5%, 1 = 5-15%, 2 = 15-25%, 3 = 25-35%, 4 = 35-45%, 5 = 45-55%, 6 = 55-65%, 7 = 65-75%, 8 = 75-85%, 9 = 85-95%, 10 = 95-100%

Average coverage is expressed to nearest percent and is only averaged for plots where plant occurred.
Where no coverage value is entered, the average coverage was less than 1%.

TABLE II CONT.

SERIES	Abco-Quga	Abies concolor					Pseudotsuga menziesii		
HABITAT TYPE	Phma	Phma	Cage	Osch	Syor	Bere	Phma	Caru	Acgl
NO. OF STANDS	n=3	n=6	n=1	n=4	n=1	n=6	n=39	n=4	n=13
GRAMINOIDS									
Agropyron spicatum	.	.	.	.	.	.	.	.	.
Agropyron trachycaulum	.	.	.	2	.	.	1	2	1
Bromus marginatus	.	.	10	.	10(2)	3	1	2(1)	3
Calamagrostis rubescens	.	.	.	.	.	.	1(4)	10(70)	2(5)
Carex geyeri	3(20)	5(20)	10(25)	2(1)	.	3(1)	4(6)	2(1)	4(7)
Carex rossii	.	3(1)	.	2	.	.	1	5	1(1)
Elymus glaucus	.	3(1)	.	7(1)	.	2(15)	3	2(8)	3(6)
Festuca idahoensis	.	.	.	.	.	.	.	.	.
Leucopoa kingii	.	.	.	.	.	.	.	.	1(1)
Melica bulbosa	.	.	.	.	.	.	.	.	.
Poa nervosa	.	.	.	.	.	.	5(2)	.	2(1)
Stipa lettermani	.	.	.	.	.	.	.	2	1(2)
FORBS									
Achillea millefolium	.	3	.	.	.	2	2	.	1(1)
Actaea rubra	.	.	.	2	.	.	.	.	2(2)
Agastache urticifolia	.	.	.	2(2)	10	2	1	2(1)	2
Aquilegia caerulea	.	.	.	.	.	2	.	2	1(3)
Arnica cordifolia	.	2	10(2)	2(1)	.	.	8(18)	5(6)	6(8)
Arnica latifolia	.	.	.	.	.	.	.	.	.
Aster engelmannii	.	5(2)	10(1)	5	10(1)	5(3)	3	5	6
Balsamorhiza sagittata	.	.	.	.	.	.	.	.	.
Chimaphila umbellata	.	.	.	2(2)	.	2	.	2	.
Disporum trachycarpum	.	3	10	2	.	2(4)	6(2)	.	8
Epilobium angustifolium	.	2(1)	.	2	.	.	1	2	2
Erigeron peregrinus	.	.	.	.	.	.	+	.	.
Erigeron speciosus	.	2	.	2	.	2(1)	.	2	.
Fragaria vesca	.	2	.	2	.	2(1)	5(3)	5(8)	6(2)
Galium aparine	3	.	.	2(7)	.	3	3(1)	.	2(4)
Galium boreale	.	.	.	.	.	2	.	.	.
Galium triflorum	.	.	10	.	.	.	2(1)	.	3(1)
Geranium fremontii	.	2(2)	.	.	10	.	1	2	2
Goodyera oblongifolia	.	3	10	2	.	.	2	2	4
Hackelia floribunda	.	.	.	.	.	.	.	.	.
Hieracium albiflorum	.	.	.	2	.	.	1	5	2
Lathyrus lanszwertii	.	2	.	.	.	.	.	.	.
Lathyrus leucanthus	3(2)	5	.	2	.	3(4)	1(2)	.	1(3)
Ligusticum filicinum	.	.	.	.	.	.	.	.	.
Lomatium nuttallii	.	.	.	.	.	.	+(1)	.	.
Mitella stauropetala	.	7(2)	10(1)	5(3)	.	2	8(2)	7(2)	7(2)
Osmorhiza chilensis	.	7	10(1)	10(24)	10(5)	5(4)	5(2)	7(2)	5(6)

TABLE II CONT.

SERIES	Abco-Quga	Abies concolor					Pseudotsuga menziesii		
HABITAT TYPE NO. OF STANDS	Phma n=3	Phma n=6	Cage n=1	Osch n=4	Syor n=1	Bere n=6	Phma n=39	Caru n=4	Acgl n=13
FORBS CONT.									
Osmorhiza depauperata	.	.	.	.	.	.	+(2)	.	2(6)
Pedicularis racemosa	.	.	.	.	.	.	+	.	2(3)
Potentilla glandulosa	.	3	.	.	.	.	.	5(1)	.
Pyrola secunda	.	.	.	2(1)	.	.	+(3)	2	2(2)
Rudbeckia occidentalis	.	.	.	2	.	.	.	.	.
Senecio integerrimus	.	.	.	.	.	.	.	.	1(2)
Senecio serra	.	.	.	2(1)	.	2	+	2	2
Senecio streptanthifolius	.	2(1)	.	2(1)	.	.	.	2	.
Silene menziesii	.	5	.	2	.	.	4(2)	2(3)	5
Smilacina racemosa	.	7(1)	10(1)	2(1)	.	5	8(3)	5	7(5)
Smilacina stellata	.	.	.	.	.	2(1)	1(2)	.	2(1)
Stellaria jamesiana	3(1)	2	10(1)	.	.	5(2)	5(1)	.	2
Thalictrum fendleri	.	2(20)	.	5(2)	10(2)	5(3)	1(2)	7(7)	3(4)
Viola adunca	.	.	.	2(2)	.	3	5(2)	7(4)	5
Viola purpurea	.	.	.	.	.	.	+	.	.

TABLE II CONT.

SERIES	Pseudotsuga menziesii cont.						Pinus flexilis	
HABITAT TYPE NO. OF STANDS	Cage n=8	Cele n=11	Osch n=21	Syor-Rim n=7	Bere n=3	Arco n-1	Artr n=2	Bere n=3
TREES								
Abies concolor	.	.	.	.	+(4)	.	.	.
Abies lasiocarpa	1(1)	.	1	4(5)	+(1)	.	.	3
Acer grandidentatum	1(5)	1(11)	5(28)	.	3(28)	.	.	.
Juniperus scopulorum	.	4(2)	2(2)	.	3(2)	.	.	.
Picea engelmannii	.	.	.	1(10)	+(1)	.	.	.
Picea pungens	.	.	.	.	.	.	.	.
Pinus contorta	1(5)	.	+(25)	.	.	.	.	.
Pinus flexilis	.	3(10)	.	7(14)	1(4)	.	10(12)	10(38)
Populus tremuloides	5(10)	.	2(25)	.	2(11)	.	.	.
Pseudotsuga menziesii	10(84)	10(24)	10(62)	10(43)	10(43)	10(89)	10(9)	3(15)
Quercus gambelii	.	.	.	.	.	.	.	.
SHRUBS								
Acer glabrum	2(2)	1	2(3)	.	3(2)	.	.	.
Amelanchier alnifolia	9(13)	7(4)	9(7)	.	7(6)	10(5)	.	3(1)
Artemisia tridentata	.	7(2)	.	7	1	.	5	10(2)
Artemisia tripartita	.	.	.	.	.	.	10(22)	.
Berberis repens	9(7)	9(5)	6(2)	3(4)	10(4)	10	10	10(4)
Ceanothus velutinus	.	6(55)	.	.	.	.	10	3(1)
Cercocarpus ledifolius	.	10(40)	.	.	3(9)	.	10(10)	7(9)
Clematis columbiana	2(3)	.	3(1)	.	1(1)	10(2)	.	.
Clematis pseudoalpina	.	.	.	.	1(2)	.	.	.
Juniperus communis	.	.	.	.	.	.	.	.
Lonicera involucrata	.	.	.	.	1(1)	.	.	.
Lonicera utahensis	.	.	.	.	.	.	.	.
Pachistima myrsinites	9(9)	8(10)	4(3)	9(2)	8(7)	10	10(2)	10(6)
Physocarpus malvaceus	1(3)	.	2(2)	.	1(4)	10(1)	.	.
Prunus virginiana	4(7)	5(10)	6(24)	1	6(13)	.	.	7(17)
Ribes montigenum	.	.	.	10(20)	.	.	.	.
Ribes viscosissimum	2	.	3	.	1	.	.	.
Rosa spp.	9(2)	4(2)	5(2)	.	7	.	.	3
Rubus leucodermis	.	.	+(1)	.	.	.	.	.
Rubus parviflorus	1	.	+(4)	.	.	.	.	.
Sambucus racemosa	.	.	1(1)	.	.	.	.	.
Shepherdia canadensis	.	1(1)	.	.	t	.	.	.
Sorbus scopulina	2(2)	.	1	.	1(3)	.	.	.
Symphoricarpos oreophilus	9(4)	10(14)	7(4)	10(10)	10(4)	10(1)	10(2)	10(4)
Vaccinium membranaceum	.	.	.	.	.	.	.	.
Vaccinium scoparium	.	.	.	.	.	.	.	.

TABLE II CONT.

SERIES	Pseudotsuga menziesii cont.						Pinus flexilis	
HABITAT TYPE	Cage	Cele	Osch	Syor-Rimo	Bere	Arco	Artr	Bere
NO. OF STANDS	n=8	n=11	n=21	n=7	n=31	n-1	n=2	n=3
GRAMINOIDS								
Agropyron spicatum	.	5(7)	+	.	+(1)	.	10(2)	7(12)
Agropyron trachycaulum	1(1)	5(2)	3(3)	6(1)	3(1)	.	10	7(1)
Bromus marginatus	1(1)	4	3	6(1)	2(1)	.	.	.
Calamagrostis rubescens	4(1)	.	3	.	1	.	.	.
Carex geyeri	10(32)	.	1(2)	.	2(1)	.	.	.
Carex rossii	.	3	1	3	1	.	.	.
Elymus glaucus	4(2)	1	7(18)	1	3	.	.	.
Festuca idahoensis	.	2	.	.	.	.	5	.
Leucopoa kingii	.	8(2)	+	9(1)	4(2)	.	10(6)	7(4)
Melica bulbosa	.	.	+(1)	4	+	.	10	3
Poa nervosa	1(3)	5(3)	2(22)	6(2)	5(4)	.	5	3(1)
Stipa lettermani	.	5(1)	+(1)	6	1	.	10(2)	7
FORBS								
Achillea millefolium	1	7	4(1)		2	.	5	7
Actaea rubra	.	.	1(1)		.	.	.	.
Agastache urticifolia	1(1)	1	4(2)		1	.	.	.
Aquilegia caerulea	1	3(4)	1	4(2)	1	1	.	.
Arnica cordifolia	6(10)	.	5(16)	.	7(9)	10(50)	.	.
Arnica latifolia	.	.	.	.	1(2)	.	.	.
Aster engelmannii	4(2)	2(1)	1	6(2)	4	.	.	3(1)
Balsamorhiza sagittata	.	5(6)	.	3(1)	+	.	10(2)	7(2)
Chimaphila umbellata	.	.	.	.	.	.	.	.
Disporum trachycarpum	7	1	2(2)	.	4	10	.	.
Epilobium angustifolium	2	.	1	.	1	.	.	.
Erigeron peregrinus	.	3	.	3	+	.	.	.
Erigeron speciosus	.	1	1	4(3)	1(1)	.	.	.
Fragaria vesca	4(1)	1(1)	4(4)	.	3(2)	10	.	.
Galium aparine	.	1	5(10)	.	1	.	.	.
Galium boreale	2	1(3)	3	1(1)	2(2)	.	.	.
Galium triflorum	.	1	2(2)	.	2(2)	.	.	.
Geranium fremontii	5	3	3(1)	4	.	.	.	3(2)
Goodyera oblongifolia	1	.	2(1)	.	1	.	.	.
Hackelia floribunda	.	3	3	6(1)	1(1)	.	.	.
Hieracium albiflorum	.	.	1	.	.	.	.	.
Lathyrus lanszwertii	1(2)	.	+(9)	.	.	.	.	.
Lathyrus leucanthus	.	.	2(22)	1(4)	1(1)	10(30)	.	.
Ligusticum filicinum	.	.	.	3(2)	.	.	.	.
Lomatium nuttallii	.	5(2)	.	4(1)	.	.	.	3
Mitella stauropetala	5(2)	.	6(4)	.	1(3)	10(3)	.	.
Osmorhiza chilensis	5(5)	3(1)	10(12)	1(7)	6(1)	10(1)	.	3

TABLE II CONT.

SERIES	Pseudotsuga menziesii cont.						Pinus flexilis	
HABITAT TYPE NO. OF STANDS	Cage n=8	Cele n=11	Osch n=21	Syor-Rimo n=7	Bere n-31	Arco n=1	Artr n=2	Bere n=3
FORBS CONT.								
Osmorhiza depauperata	1(5)	.	1(13)	1(4)	1	.	.	.
Pedicularis racemosa	.	1	.	1	.	.	.	.
Potentilla glandulosa	.	.	+	2	+(1)	.	.	.
Pyrola secunda	1	.	1	.	+(1)	.	.	.
Rudbeckia occidentalis	.	.	+(1)	.	.	.	.	.
Senecio integerrimus	.	3	+(5)	1(2)	.	.	.	7
Senecio serra	.	.	3	.	t	.	.	.
Senecio streptanthifolius	.	2	+	9	1	.	.	.
Silene menziesii	4	2(1)	4	1	4	10(1)	.	3
Smilacina racemosa	5(2)	2	6(3)	.	7(4)	.	.	.
Smilacina stellata	.	.	1(5)	.	1	.	.	.
Stellaria jamesiana	5(2)	5(4)	7(3)	10(2)	5(5)	.	.	.
Thalictrum fendleri	7(3)	3(1)	6(2)	3	3(2)	10(2)	.	3(3)
Viola adunca	2(1)	.	3	1	4(3)	.	.	.
Viola purpurea	.	3	.	3(2)	t	.	.	7

TABLE II CONT.

SERIES	Abies lasiocarpa								
HABITAT TYPE NO. OF STANDS	Juco n=1	Vame n=23	Vasc n=5	Phma n=10	Acgl n=7	Rupa n=7	Caru n=6	Cage n=2	Arla n=12
TREES									
Abies concolor	•	•	•	3(16)	•	1(5)	•	•	•
Abies lasiocarpa	10(2)	10(27)	10(17)	10(37)	10(38)	10(45)	10(25)	10(34)	10(36)
Acer grandidentatum	•	•	•	3(2)	4(4)	•	2(2)	5(1)	•
Juniperus scopulorum	•	•	•	•	•	•	•	5(3)	•
Picea engelmannii	10(3)	9(42)	10(35)	7(19)	•	6(16)	2(1)	•	10(34)
Picea pungens	•	•	•	1(4)	•	•	•	•	•
Pinus contorta	•	4(31)	•	•	•	•	8(50)	5(6)	•
Pinus flexilis	10(28)	•	•	•	•	1(3)	•	•	2(4)
Populus tremuloides	•	•	•	3(10)	•	1(31)	7(24)	5(1)	1(7)
Pseudotsuga menziesii	10(30)	4(12)	•	9(44)	10(33)	9(26)	8(36)	10(44)	4(23)
Quercus gambelii	•	•	•	•	•	•	•	•	•
SHRUBS									
Acer glabrum	•	•	•	4(12)	10(17)	3(4)	•	•	•
Amelanchier alnifolia	•	2(1)	•	10(12)	9(2)	9(4)	10(3)	•	•
Artemisia tridentata	•	•	•	•	•	•	•	•	1
Artemisia tripartita	•	•	•	•	•	•	•	•	•
Berberis repens	•	•	•	•	9(2)	7	7(3)	5	•
Ceanothus velutinus	•	•	•	8(2)	•	•	•	•	•
Cercocarpus ledifolius	•	•	•	•	•	•	•	•	•
Clematis columbiana	•	•	•	7(10)	•	4(2)	•	•	•
Clematis pseudoalpina	•	•	•	•	•	•	•	•	•
Juniperus communis	10(35)	•	•	•	•	•	•	•	•
Lonicera involucrata	•	2(3)	2	3	•	1	2(1)	•	2(4)
Lonicera utahensis	•	2(2)	•	7(4)	1(1)	7(4)	2(5)	•	4
Pachistima myrsinites	•	•	2(1)	8(16)	10(3)	10(13)	8(5)	10(4)	7
Physocarpus malvaceus	•	8(1)	•	10(30)	1(1)	3(2)	•	•	•
Prunus virginiana	•	•	•	3(2)	7(2)	•	2(10)	5(25)	•
Ribes montigenum	•	4(1)	8(2)	•	•	1	•	•	8(2)
Ribes viscosissimum	•	3(1)	•	•	4	6	2	5	•
Rosa spp.	•	1	2	5(1)	10	7	8	5(1)	2
Rubus leucodermis	•	•	•	•	•	1(1)	•	•	•
Rubus parviflorus	•	4(1)	2(1)	6(5)	1(5)	10(28)	3	•	1(3)
Sambucus racemosa	•	+(2)	•	•	•	3(3)	•	•	•
Shepherdia canadensis	•	3(6)	•	1	•	1(1)	•	•	2
Sorbus scopulina	•	7(1)	4	9(8)	9(4)	7(12)	3(11)	•	3
Symphoricarpos oreophilus	•	+	2(1)	8(5)	9(6)	7	8(2)	10(5)	•
Vaccinium membranaceum	•	10(45)	2(1)	•	•	•	•	•	3
Vaccinium scoparium	•	1(3)	10(19)	•	•	•	•	•	1(1)

TABLE II CONT.

SERIES	Abies lasiocarpa								
HABITAT TYPE NO. OF STANDS	Juco n=1	Vame n=23	Vasc n=5	Phma n=10	Acgl n=7	Rupa n=7	Caru n=6	Cage n=2	Arla n=12
GRAMINOIDS									
Agropyron spicatum	•	•	•	•	•	•	2(8)	•	•
Agropyron trachycaulum	•	•	•	•	•	•	•	•	•
Bromus marginatus	•	+	2	1	1	6(3)	2(3)	5(3)	1
Calamagrostis rubescens	•	+	•	•	1(4)	•	10(32)	5(1)	•
Carex geyeri	•	1	2	2(4)	1(5)	3(3)	5	10(32)	•
Carex rossii	•	1	10(1)	2	3	4	7(2)	•	4(6)
Elymus glaucus	•	1(2)	2	•	6	3	2	10(2)	•
Festuca idahoensis	•	•	•	•	•	•	•	•	•
Leucopoa kingii	•	•	•	•	•	•	•	•	•
Melica bulbosa	•	•	•	•	•	•	•	5(3)	•
Poa nervosa	10	1	4	•	•	•	3	•	2
Stipa lettermani	•	•	•	•	•	•	•	5(4)	•
FORBS									
Achillea millefolium	•	1	10(2)	•	1	•	2	•	5
Actaea rubra	•	+	•	•	1(10)	3	•	•	•
Agastache urticifolia	•	•	•	•	3	1	2	•	•
Aquilegia ca ulea	•	5(1)	4	4	1	6(1)	•	•	3(2)
Arnica cordifolia	•	7(3)	6(2)	5(5)	9(1)	7(2)	10(10)	5(15)	8(1)
Arnica latifolia	•	7(16)	10(18)	•	•	1(3)	•	5	10(10)
Aster engelmannii	•	7(2)	8(1)	•	9	9	5	•	5(2)
Balsamorhiza sagittata	•	•	•	•	•	•	•	•	•
Chimaphila umbellata	•	2	•	1	1(1)	1	3(3)	•	•
Disporum trachycarpum	•	+	•	5	7	3	2(1)	•	•
Epilobium angustifolium	•	3	6	•	1	3	3	5	1
Erigeron peregrinus	•	2	2(4)	•	•	•	3	5	1
Erigeron speciosus	•	2	2(2)	•	•	•	•	•	•
Fragaria vesca	•	2(1)	•	8	4	7	3(1)	•	•
Galium aparine	•	•	•	3(7)	•	•	•	•	•
Galium boreale	•	+	•	•	•	•	2	5(1)	•
Galium triflorum	•	+	•	•	9(1)	4(4)	•	•	•
Geranium fremontii	•	3	6(2)	•	•	1	3	5(1)	3
Goodyera oblongifolia	•	+	•	5	6	6	5	•	1(1)
Hackelia floribunda	•	1	2	•	3	1(2)	2	•	1
Hieracium albiflorum	•	3	•	1	3	4	7	5(5)	2(3)
Lathyrus lanszwertii	•	•	•	•	•	•	•	•	•
Lathyrus leucanthus	•	•	•	•	1(10)	1	•	•	•
Ligusticum filicinum	•	3	8(1)	•	•	•	•	•	3
Lomatium nuttallii	1	•	•	•	•	•	8(1)	•	•
Mitella stauropetala	•	4	•	8(2)	10	4	7(1)	5(3)	3
Osmorhiza chilensis	•	6(2)	10(2)	8(4)	10(9)	10(2)	•	5(8)	6

TABLE II CONT.

SERIES	Abies lasiocarpa								
HABITAT TYPE NO. OF STANDS	Juco n=1	Vame n=23	Vasc n=5	Phma n=10	Acgl n=7	Rupa n=7	Caru n=6	Cage n=2	Arla n=12
FORBS CONT.									
Osmorhiza depauperata	.	4(2)	.	.	.	.	3(4)	5(6)	2
Pedicularis racemosa	.	9(6)	10(4)	1(1)	3(2)	6(1)	3(5)	.	9(3)
Potentilla glandulosa	.	1	2	.	.	.	.	.	2
Pyrola secunda	1	8(2)	4(1)	9(1)	7	10(2)	3(2)	5(3)	7(2)
Rudbeckia occidentalis	.	.	.	.	.	.	2(1)	.	1
Senecio integerrimus	.	.	4	.	.	.	.	.	.
Senecio serra	.	.	.	.	1	1	2	.	.
Senecio steptanthifolius	.	.	.	.	.	.	.	5(1)	1
Silene menziesii	.	1	.	2	4	3	7(2)	5(1)	.
Smilacina racemosa	.	.	.	3	6	1	.	.	.
Smilacina stellata	.	.	.	.	.	1	.	.	.
Stellaria jamesiana	.	2	8(2)	.	4	1(3)	2(1)	.	3(1)
Thalictrum fendleri	.	4	.	7	10(6)	9(2)	5	5(2)	3
Viola adunca	.	1	.	.	4	1	5	5	1
Viola purpurea	.	.	.	.	1	.	.	.	1(2)

TABLE CONT.

SERIES	Abies lasiocarpa cont.					
HABITAT TYPE NO. OF STANDS	Osch n=16	Bere n=81	Rimo n=22	Lale n=5	Pera n=10	Arco n=5
TREES						
Abies concolor	•	+(15)	•	•	•	•
Abies lasiocarpa	10(45)	10(34)	10(43)	10(53)	10(42)	10(19)
Acer grandidentatum	•	+(15)	•	•	•	•
Juniperus scopulorum	•	•	•	•	•	•
Picea engelmannii	3(13)	3(20)	5(41)	6(56)	8(29)	4(24)
Picea pungens	•	•	•	•	•	•
Pinus contorta	1(44)	3(39)	•	•	6(36)	8(57)
Pinus flexilis	•	1(13)	1(9)	•	•	•
Populus tremuloides	3(32)	4(19)	1	•	•	6(47)
Pseudotsuga menziesii	7(36)	8(40)	2(35)	6(3)	3(14)	4(9)
Quercus gambelii	•	•	•	•	•	•
SHRUBS						
Acer glabrum	1(1)	+(1)	•	2(1)	•	•
Amelanchier alnifolia	2(6)	5(3)	•	•	3(2)	4
Artemisia tridentata	•	•	•	•	•	2
Artemisia tripartita	•	•	•	•	•	•
Berberis repens	2(1)	6(2)	•	•	2	4(2)
Ceanothus velutinus	•	•	•	•	1(4)	2(7)
Cercocarpus ledifolius	•	•	•	•	•	•
Clematis columbiana	1	1(4)	•	•	•	•
Clematis pseudoalpina	•	•	•	•	•	•
Juniperus communis	•	•	•	•	•	•
Lonicera involucrata	1	+(2)	+(1)	•	•	•
Lonicera utahensis	1(1)	3(1)	•	4	4(1)	•
Pachistima myrsinites	4(2)	9(7)	2	4(1)	7(9)	8
Physocarpus malvaceus	•	+(1)	•	•	•	•
Prunus virginiana	1(35)	2(9)	•	•	•	•
Ribes montigenum	4(3)	2(3)	10(19)	4(1)	3	•
Ribes viscosissimum	1(4)	2	+	•	2	•
Rosa spp.	2	6	+	•	2	2
Rubus leucodermis	•	+(34)	•	2(4)	•	•
Rubus parviflorus	2(1)	1(1)	•	2(1)	2	4(2)
Sambucus racemosa	2(2)	•	4(2)	•	•	•
Shepherdia canadensis	•	2(1)	•	•	3(18)	2
Sorbus scopulina	4(4)	3(5)	2	4	4(1)	2
Symphoricarpos oreophilus	6(3)	9(4)	6(2)	4(4)	2	4
Vaccinium membranaceum	•	+	•	•	2(2)	2
Vaccinium scoparium	•	•	•	•	•	•

TABLE II CONT.

SERIES			Abies lasiocarpa cont.			
HABITAT TYPE NO. OF STANDS	Osch n=16	Bere n=81	Rimo n=22	Lale n=5	Pera n=10	Arco n=5
GRAMINOIDS						
Agropyron spicatum	.	+	.	.	.	.
Agropyron trachycaulum	1(1)	1(1)	1	.	.	.
Bromus marginatus	3(1)	3(1)	4	4	2	.
Calamagrostis rubescens	1(2)	1	.	.	1(2)	1
Carex geyeri	1(3)	1(2)	+(3)	.	1(1)	2(2)
Carex rossii	5	4	4	8	8(4)	6
Elymus glaucus	2(5)	2(2)	1(1)	.	.	2
Festuca idahoensis	.	+	.	.	.	.
Leucopoa kingii	.	1(1)	1			
Melica bulbosa	1	1	+	.	.	.
Poa nervosa	4(3)	2(1)	1	2	4(1)	6(1)
Stipa lettermani	1	1	1	2	.	.
FORBS						
Achillea millefolium	2	2	4	2	4(1)	2
Actaea rubra	1	+(6)	+(4)	2(10)	.	.
Agastache urticifolia	2(1)	1(2)	1	4	.	.
Aquilegia caerulea	5	3	7(2)	8	4(1)	4
Arnica cordifolia	4(10)	7(6)	4(6)	8(1)	6(4)	10(6)
Arnica latifolia	.	+	+(1)	.	3(2)	2
Aster engelmannii	5(4)	6(2)	7(2)	4(1)	7(6)	6(1)
Balsamorhiza sagittata	.	+(2)	+	.	.	.
Chimaphila umbellata	.	1(1)	.	.	3(2)	.
Disporum trachycarpum	.	1	.	2	.	.
Epilobium angustifolium	.	1	2	2(3)	2	1
Erigeron peregrinus	.	1	+	2	1(1)	.
Erigeron speciosus	2	1	2(1)	.	.	.
Fragaria vesca	2(2)	2(2)	+	2	1	6
Galium aparine	1	+(1)	.	.	.	.
Galium boreale	2	+(3)	.	.	.	2
Galium triflorum	2(2)	+	+(1)	2(2)	.	.
Geranium fremontii	2(2)	5	3(1)	4	6	6(1)
Goodyera oblongifolia	.	2	.	2	2(1)	.
Hackelia floribunda	6	2	6(1)	6	2(1)	.
Hieracium albiflorum	1	1	+	4	3	2
Lathyrus lanszwertii	.	1(2)	1(5)	.	.	.
Lathyrus leucanthus	2(24)	+(5)	2(12)	10(38)	.	.
Ligusticum filicinum	1(2)	+	2	2	3	2
Lomatium nuttallii	.	+(16)	+	.	.	.
Mitella stauropetala	6(2)	3(1)	3(1)	4	1	2
Osmorhiza chilensis	9(12)	7(1)	7(3)	10(1)	8	8(1)

TABLE II CONT.

SERIES	Abies lasiocarpa cont.					
HABITAT TYPE NO. OF STANDS	Osch n=16	Bere n=81	Rimo n=22	Lale n=5	Pera n=10	Arco n=5
FORBS CONT.						
Osmorhiza depauperata	1(10)	1(2)	1(7)	.	1(1)	2
Pedicularis racemosa	2	3(3)	3(4)	6(3)	10(11)	4(2)
Potentilla glandulosa	2	1	4	2	3(2)	.
Pyrola secunda	.	4(1)	1(1)	4	7(2)	2(1)
Rudbeckia occidentalis	1	+(3)	1	.	1	.
Senecio integerrimus	1(1)	+	+(1)	.	2	.
Senecio serra	1	+	1	2(1)	.	2
Senecio steptanthifolius	.	1	3	2	.	.
Silene menziesii	4(1)	3	1(1)	2(1)	2	2
Smilacina racemosa	3	1	+	.	.	.
Smilacina stellata	1(10)	.	1(1)	.	.	.
Stellaria jamesiana	9(3)	6(2)	8(3)	10(1)	6(3)	8
Thalictrum fendleri	7(3)	7(3)	5	4	4	4
Viola adunca	6(2)	3	1(3)	.	2	4
Viola purpurea	1	1	.	.	1	4